PROCEEDINGS

OF THE

FORTY-FOURTH ANNUAL MEETING

OF THE

FLORIDA STATE HORTICULTURAL SOCIETY

HELD AT

MIAMI AND HOMESTEAD, FLORIDA
APRIL 14, 15, 16, AND 17

1931

AND OF

SPECIAL MEETING

HELD AT

MARIANNA, FLORIDA
OCTOBER 14 AND 15
1930

PUBLISHED BY THE SOCIETY
OFFICE OF PUBLICATION, DELAND, FLORIDA

Florida State Horticultural Society
Officers Elect for 1932

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EXECUTIVE COMMITTEE

PROF. W. L. DREW, Eagle Lake

H. HAROLD HUME, Glen St. Mary

FRANK STIRLING, Davie

Constitution

Article 1. This organization shall be known as The Florida State Horticultural Society, and its object shall be the advancement of Horticulture.

Article 2. Any person or firm may become an annual member of the Society by subscribing to the Constitution and paying two dollars. Any person or firm may become a perennial member of the Society by subscribing to the Constitution and paying the annual dues for five or more years in advance. Any person may become a life member of the Society by subscribing to the Constitution and paying twenty-five dollars. Any person or firm may become a patron of the Society by subscribing to the Constitution and paying one hundred dollars.

Article 3. Its officers shall consist of a President, three Vice-Presidents, Secretary, Treasurer, and Executive Committee of three, who shall be elected by ballot at each annual meeting. These officers shall take their positions immediately following their election.

Article 4. The regular annual meeting of this Society shall be held on the second Tuesday in April, except when otherwise ordered by the Executive Committee.

Article 5. The duties of the President, Vice-Presidents, Secretary and Treasurer shall be such as usually devolve on these officers. The President, Secretary and Treasurer shall be ex-officio members of the Executive Committee.

Article 6. The Executive Committee shall have authority to act for the Society between annual meetings.

Article 7. The Constitution may be amended by vote of two-thirds of the members present.

By-Laws

1. The Society year shall be co-extensive with the calendar year, and the annual dues of members shall be two dollars.

2. All bills authorized by the Society or its Executive Committee, for its legitimate expenses, shall be paid by the Secretary's draft on the Treasurer, O. K'd by the President.

3. The meetings of the Society shall be devoted only to Horticultural topics, from scientific and practical standpoints, and the Presiding Officer shall rule out of order all motions, resolutions and discussions tending to commit the Society to partisan politics or mercantile ventures.

4. All patron and life membership dues and all donations, unless otherwise specified, shall be invested by the Treasurer in United States bonds. Only the interest on these bonds shall be available for payment of the current expenses of the Society. Perennial membership dues shall be placed on deposit at interest by the Treasurer. Only two dollars and the interest from each perennial membership fee shall be available for use in payment of the current expenses of the Society during any particular year.

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Shaw, Miss Eleanor G., Gainesville, Fla.
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Turlington, J. E., Gainesville.
Ulmer, H. D., Largo.
Vannah, H. P., cr. Brown Co., Belle Glade.
Valentine, Geo. C., Palmetto.
Velboon, G. L., Largo.
Virginia-Carolina Chemical Corp., Jacksonville.
Virrick, V. E., 2620 Biscayne Blvd., Miami.
Vissering, Harry, Babson Park.
Vissering, N. H., Babson Park.
Vivian, H. B., 2923 N. W. 7th St., Miami.
Wakeman, W. H., Rt. 2, Box 143 L, Orlando.
Waldron, Max, Babson Park.
Walker, Eli C., Vero Beach.
Walker, Marvin H., Tampa.
Wallace, J. W., Jacksonville.
Walsh, C. A., cr. Walsh Citrus Co., R. R. I, Ft Lauderdale.
Warren, Alfred, County Agent, Ft. Pierce.
Watson, Dr. J. R., Gainesville.
Watt, Wm., Mount Dora.
Westbrook, Sam W., cr., L. & N. Ry., Pensacola.
White, Dr. Roland T., 211 S. Rosalind, Orlando.
Whitmarsh, R. D., DeLand.
Whittington, J. A., Merritt.
Williams, C. N., P. O. Box 892, Orlando.
Williams, Miss Myra G., Rockledge.
Williams, S. F., Jacksonville.
Wilmshurst, H. J., DeLand.
Wilson & Toomer Fertilizer Co., Jacksonville.
Wing, G. D., P. O. Box 892, Orlando.
Winston, J. R., Orlando.
Wolfe, H. S., Homestead.
Woods, V. E., Davenport.
Woodson, Henry P., P. O. Box 667, Clearwater.
Woolfolk, R. B., P. O. Box 892, Orlando.
Worn, C. W., Bradenton.
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Yothers, W. W., Orlando.

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Daetwyler, M. J., Orlando.
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Drew, Dr. Gilman F., Eagle Lake.
Drew, Mrs. Gilman F., Eagle Lake.
Duncan, R. W. A., Frostproof.
Emerson, Miss Z. P., Rt. 1, Box 238, Lakeland.
Florence Citrus Growers Association, Florence Villa.
Floyd, B. R., Box 146, Lake Hamilton.
Frampton, R. M., St. Cloud.
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Handleman, H. C., Lake Wales.
Hannah, J. B., Kathleen Rd., Lakeland.
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Holland, Judge S. L., Bartow.
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Kelly, R. W., Box 1959, Orlando.
King, Frank O., Kissimmee.
King, Mrs. Frank O., Kissimmee.
Kissimmee Citrus Growers Association, Kissimmee.
Klemm, A. M. & Son, Winter Haven.
Linderman, R. H., Lake Wales.
Mallett-Brown Co., Frostproof.
Mason, E. C., Lake Wales.
Mathias, A. C., Lake Wales.
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Olsen, C. I., Box 6, Winter Haven.
Orlando Citrus Growers Association, Orlando.
Pearce, W. O., Bartow.

Peterson, J. A., Rt. 1, Box 208, Lakeland.
Pilkington, C. R., Orlando.
Polk County Citrus Sub-Exchange, Bartow.
Pollock, John D., Rt. 1, Box 129, Lakeland.
Poole, Mrs. S. F., Lake Alfred.
Quaintence, W. D., Lake Wales.
Robinson, J. Curtis, 802 State Bank Bldg., Orlando.
Simonson, Dr. L. M., Lake Alfred.
Sligh, S. J., Orlando.
Smith, L. Longfield, Box 1256, Winter Haven.
Spencer, W. C., Lake Alfred.
Starnes, Thomas Lowe, Box 1196, Winter Haven.
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Stuart Bros., Bartow.
Stull, Jay, Winter Haven.
Thompson, C. H., Winter Haven.
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Villa Groves Inc., Winter Haven.
Wakelin, G. M., 16 N. Court, Orlando.
Wakelin, Mrs. G. M., 16 N. Court, Orlando.
Wells, W. G., Winter Haven.
Winter Haven Citrus Growers Association, Box 308, Winter Haven.
Zangen, O. V., Davenport.

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PROCEEDINGS
OF THE
FLORIDA
STATE HORTICULTURAL SOCIETY

VOL. XLIV PRINTED 1931

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Forty-fourth Annual Meeting of the Florida State Horticultural Society

The Forty-Fourth Annual Meeting of the Florida State Horticultural Society, held in Miami and Homestead, the home of the late William J. Krome, proved to be one of intense interest and much enjoyment to those in attendance. A well lighted, quiet and comfortable meeting place on the seventeenth floor of the Hotel Columbus, overlooking Biscayne Bay and Miami Beach; amplifiers, installed through the courtesy of the Miami Rotary Club and the Robinson Electric Company, making it easy to hear each speaker in every part of the room; a most excellent program emphasizing particularly sub-tropical fruits; the garden party at the home of Dr. and Mrs. David Fairchild, airplane trips over Miami and Miami Beach and surrounding country through the courtesy of County Commissioners of Dade County; motorcade to the beautiful Matheson Park, the Plant Introduction Garden at Chapman Field and through the southern part of the county, including dinner and final session of the meeting at the Country Club at Homestead, were some of the high lights of the meeting.

As is usual, a successful meeting can be attributed in a large measure to a small group of men who carry the responsibility of local arrangements. The outstanding man in the group to whom credit is due is the efficient County Agricultural Agent of Dade County, Mr. J. S. Rainey, who was on hand at all times looking after the details of the meeting and the comfort and pleasure of the members. Others who contributed much were C. H. Steffani, the County Agricultural Agent of South Dade County, our genial Vice-President C. I. Brooks, C. H. Crandon, Chairman of the County Commissioners of Dade County, Dr. and Mrs. David Fairchild, Mrs. Arthur Curtis James, K. Dahlberg and others too numerous to mention.

The program was very complete, covering every phase of Sub-Tropical horticulture. There was no address that was particularly outstanding, but every paper was pertinent and of much interest. The attendance at each session was good and interest sustained. Owing to illness, President John S. Taylor was unable to be present. The meetings were ably presided over by Vice-Presidents S. F. Poole, assisted by Vice-President Chas. I. Brooks.

Florida Rose Society

The sixth annual meeting of the Florida Rose Society, was held coincident with the meeting of the Horticultural Society in Miami. Its sessions were held in the parlors of the Columbus Hotel and interesting addresses were given by M. B. Coe, H. Harold Hume and others. Mrs. E. L. Lord of Gainesville who has been president of the Society since its organization at Cocoa in April, 1925, resigned and was succeeded by Mrs. S. F. Poole of Winter Haven. A very successful Rose show was staged in the hotel under the supervision of Mary Drake and Gerry Curtis.

Society Affairs

The Secretary invites the attention of the members to the shrinking membership. It is with difficulty that its officers are able to publish its proceedings this year due to the decreased income from membership fees. It is imperative that the members take a more active interest in the financial affairs of the Society if it is to carry on. Consideration should be given at the coming meeting to this situation.

Stahl and Allison Papers

Figures in connection with the papers: Stahl—Composition of Florida Avocados, page 81, and Allison—The Importance of Certain Special Elements in the Agriculture of South Florida, page 11, will be found in the back of the Proceedings.

PROCEEDINGS

OF THE

Florida State Horticultural Society

FORTY-FOURTH ANNUAL MEETING

MIAMI AND HOMESTEAD, APRIL 14, 15, 16 AND 17, 1931

OPENING SESSION

Columbus Hotel, Miami

S. F. Poole, Vice-President: The Forty-fourth Annual Meeting of the Florida State Horticultural Society is now in session. Dr. Clinton of Miami will lead us in the opening invocation.

Invocation by Dr. Wm. G. Clinton, Miami

ADDRESS OF WELCOME

By E. G. Sewell, City Commissioner, Miami

On behalf of the city, it is my very great pleasure to welcome you here. I hope your visit will be a pleasant one. I realize that you men represent the backbone of Florida. We have our tourist business, and our other businesses, but the fruit business—the business of Horticulture is very important to us and to the State. It is the advantages of our Horticulture that bring a great many people to Florida, and by attracting people to Florida, you attract business.

All growers have had their experience with the present depression, no doubt, and you might feel as if your business has been a poor one during the past year. But you may rest assured that all other businesses have also been poor, not only in Florida, but everywhere over the country. Reports, we have received, show that other States are in as bad condition as Florida.

I have felt for a long time, however, that we are very poor salesmen, when it comes to selling our products. I think California has us beaten a lot. They seem to be able to bring their water two to three hundred miles, grow their products, ship them two or three thousand miles, and sell them for more than we are able to sell ours. I said years ago that if I wanted to be Governor of Florida I would work out an improvement on the marketing system. I felt like that when I was trying to grow tomatoes. I used to finance a man in growing tomatoes and we would ship our cars to the Potomac yards and get the prices in New York, Boston and Baltimore, and I re-

member one time we were quoted a price of $2.75 in Baltimore. We rolled our car the next day and they sent us $1.75. I never could understand why it would drop $1.00 a crate in one day. I feel like we ought to be smart enough to get the money out of these products after we grow them; at least as much in proportion as California is apparently receiving.

I worked out a little plan one time. We had a meeting of the State Chamber of Commerce in Orlando. It was suggested that we follow the plan of Swift & Co., and Armour & Co., but the trouble with that plan and the only loophole, is that you haven't enough produce to keep your central supply stations in the North going the year around.

I was walking up Sixth Avenue in New York during this past winter, and I saw some nice looking grapefruit in a retail store there. They were marked 30c each. I said "Well, what do you pay for them?" He says "Oh, those are very fine, very fine, select." I says "Yes, I notice they are very nice, but I am just wondering how much the grower down in Florida got for that grapefruit." We talked along, and I said "I don't know whether he got over five or six cents, and you are getting thirty. It looks to me like you ought to be able to sell grapefruit for three times, over the actual cost, without charging six or seven times that." In the better restaurants they are charging 40c for half a grapefruit. The grower is perhaps getting three or four cents for a whole one.

I think Florida ought to rise to the situation and find some way to get a fair price in proportion to the retail price. We don't need to charge the people any more. I think they are paying a fair price, but the grower is not getting his part and I don't believe you will ever get it until you organize, establish supply depots in each State, and set your price according to supply and demand. You must find some way to control your shippers. Get them into two organizations, as I see it. I don't believe you can control all shipping through one, but I think you should be able to do it through two organizations. The two could work together a little. If a man didn't want to do business with one man he could with the other.

You ought to be able to control at least, ninety-five per cent of the production that way, and I am sure you would get the money out of it, like Armour and Swift do. It isn't anything new. They get the price out of meat.

There is a great depression throughout the country. You are still paying a good price for meat, just because they have a system. That's what we need in Florida—a system to sell these products. I don't believe the growers of Florida are getting fifty per cent of what they are entitled to. That's my honest opinion.

I believe if you organize, you will get this money you are entitled to. It all depends, however, on organization, and getting all the growers in not more than two or three organizations, and then letting the organizations work together. That's what the big companies are doing. Of course, they are not working so good now, with the prices down a little because of over-production, but as a rule they get theirs. The Standard Oil made more money last year than any other year. It all depends on organization. I think we ought to get busy and organize, and have our producers get what's coming to them.

If there is anything we can do, let us hear what it is. Call up the city manager, and tell him about it, and if he don't give it to you, let me know. I thank you.

RESPONSE TO ADDRESS OF WELCOME

S. F. Poole, Winter Haven

In the absence of Mr. Taylor, it falls upon me to do not only the presiding, but also to make the Response to the Address of Welcome. Mr. Taylor is unfortunately ill at this time, and so is Mr. Brooks also, who is one of the Vice Presidents of this Society, and sometime tomorrow proper resolutions will be presented in regard to these gentlemen.

We have listened to Mr. Sewell's Address of Welcome, and we are going to assure Mr. Sewell that we are going to adopt his plans. We have been working on something like that for years.

We are here, Mr. Sewell. We are glad we are here, and we are glad that you have extended to us what you virtually mean the keys of the city and if we see anything we want we are going to take it. We have your permission to do that, have we?

A number of years ago, down here in Miami, on the streets, the little birds were saying "Cheap, Cheap!", which meant the real estate men were offering property to northern buyers saying, "Really we are ashamed to quote such a price to you; it's altogether too cheap; we know its worth a great deal more, but we are willing to make this sacrifice if you will only buy." Today you hear those same birds on the streets. They have changed their tune; they say "Chirp, chirp, chirp," which means "Cheer up, Cheer up; Better times are just around the corner." Better times are coming to us. We have been down to the bottom, and now we are on the upgrade.

In spite of our address of welcome, we should not take that point of view altogether, but we should feel cheered up, from what we hear the birds say on the streets.

You have a great many beautiful things here in this city—things and otherwise. You know I feel somewhat like a little boy coming down the street one day; he saw a beautiful girl dressed in a style of not later than the Stone Age. I noticed he had only one eye open. I asked him why. "Oh," he says, "I don't think its safe to risk more than one." So perhaps we should come here Mr. Sewell, but we are coming, with both our eyes open, to see all the beautiful things; all the beautiful sights you have in this community, and your environments. We know you have them, and we are here to take advantage of them, throughout the fullest extent of our time. We are glad you have welcomed us. We are glad we are here, and we hope that we will find the key on the outside of these places. I thank you.

Vice-President Poole: Owing to the absence of President Taylor, the next number on the program, which is the President's annual address, will be passed, and after an announcement by Mr. Rainey we will adjourn to meet Wednesday morning at 9:30 a. m., in the dining room of the Columbus hotel where all further sessions of the Society in Miami will be held.

Announcement by Mr. J. S. Rainey, Miami: At the conclusion of the evening's session you are all cordially invited to go to the amphitheatre in the Bayshore Park across the street and enjoy the program that is being put on for your special enjoyment and benefit. Immediately after the program Caesar LaMonica, who took the Bugle Corps prize, and brought back the national championship, is going to take possession of the Boulevard and furnish music for you folks to dance to.

We want you to enjoy the program here, and at the conclusion I hope you will join us at the amphitheatre and enter into the spirit of the festivities.

At the opening of the morning session, Wednesday, April 13th, 1931, Mr. S. F. Poole, presiding, read a telegram from the President of the Horticultural Society, Mr. John S. Taylor, which was as follows:

"Due to very severe sickness, now the third day in bed, find it impossible to attend Miami meeting, which regret more than words can express. Wish for the Society one of their most successful sessions."

Announcement: Mr. J. J. Skinner who was to be with us this morning wires us that he will be unable to attend, and in his place Mr. G. M. Bahrt of Orlando will read his paper "The Trend of Fertilizer Practices."

TREND OF FERTILIZER PRACTICE WITH REFERENCE TO CITRUS CULTURE IN FLORIDA

J. J. SKINNER AND G. M. BAHRT

Soil Fertility Investigations, Bureau of Chemistry and Soils
United States Department of Agriculture

Since the World War no industry, possibly, has undergone such rapid changes as the fertilizer industry, and these changes have played a significant part in the post-war development in agriculture. The challenge flung to the world's manufacturers of chemicals at the outbreak of the war to supply nitrogen compounds with which to furnish modern explosives for the armies was met by an almost miraculous development of nitrogen fixation plants whose products have since become available to agriculture. A campaign of research and industrial development has resulted in the production of a number of concentrated nitrogen compounds having desirable chemical and physical qualities for use in fertilizer mixtures with phosphate and potash or for separate applications.

In the earlier years the class of nitrogen material, commonly spoken of as "organics," filled a big place in the fertilizer industry. Many of these have found a more profitable use since the advent of cheaper supplies of synthetic and by-product inorganic nitrogen.

Prior to 1914 less than 100,000 tons of nitrogen were supplied annually in the world by air fixation processes as compared to three-quarters of a million tons of nitrogen supplied by Chilean nitrate and by-product ammonia. In 1929 one and a quarter million tons of pure nitrogen were supplied by air fixation processes, which is somewhat more than was supplied by Chilean nitrate and by-product ammonia that year. Experts predict that by 1935 the world's supply of combined nitrogen will be substantially in excess of three million tons and that seventy per cent of that supply will be represented by nitrogen fixation products.

The methods developed for producing phosphates for the fertilizer industry have undergone changes almost as striking as those noted for producing supplies of combined nitrogen. Processes have been devised for the manufacture of phosphoric acid by smelting phosphate rock in electric and blast furnaces thereby permitting the production of more concentrated superphosphate. The manufacture of ammonium phosphate, with synthetic nitrogen and phosphoric acid as raw materials, has assumed large proportions.

With large supplies of concentratetd nitrogen and phosphorus compounds available, there has been notable progress in the economical manufacture of mixed fertilizers. From year to year these have shown an increase in units of the plant food elements, nitrogen, phosphorus and potassium. Early in the present century mixed fertilizers containing ten units of plant food were not uncommon. Within recent years preference has been given to the manufacture of mixtures containing fifteen to twenty units of plant food, and the user of fertilizer can now obtain mixtures containing fifty or even more units of plant food if he wishes. A survey made by the National Fertilizer Asociation in 1928 showed that the fertilizer then used in Florida for citrus had an average of eighteen units of plant food. With the increased use of concentrated fertilizers this figure is nudoubtedly higher today.

Obviously, the greater the concentration of nitrogen, phosphoric acid and potash in fertilizers, the less these contain of other salts and of impurities, and the quicker is the relative solubility of these plant food mixtures. The use of these modern fertilizers creates new problems for the grower, especially when used on thin sandy soil containing but little inherent nutrient materials or when used to grow a crop such as the citrus tree which is subject to nutritional disturbances and sensitive to a deficiency or an excess of any essential plant food. These concentrated materials are a great contribution to agriculture and they have a very distinct place in the fertilizer industry. However, there is much

to learn of the effect of these materials on tree growth and fruit quality. The results of carefully planned field and laboratory experiments should guide the grower in their use. Consideration should be given the chemical nature of the compounds, the quantity employed and time and method of application. An appreciable tonnage of concentrated chemical fertilizers is being used in various sections of Florida by growers and the results are being watched with interest.

In the production of Florida's citrus fruit with modern fertilizer materials there is much research still to be done and a need for far-reaching technical work in developing a fertilizer practice for growing and maintaining healthy and thrifty trees capable of producing large yields of quality fruit. With the development of cheap chemical fertilizers and a growing scarcity and and higher cost of organic nitrogen material, what will be the trend of fertilizer practice in producing citrus economically?

With recognition of the value of nitrogen application on tree growth and yield, and the value of potash on fruit quality, there seems to have come a tendency in localized sections to break away from the stereotyped practice of applying a fixed analysis three times a year. Some growers make a separate application of nitrogen, phosphate and potash as their judgment dictates. However, the established custom of applying mixtures periodically undoubtedly prevails in the most highly developed citrus belts. Frequently the grower uses, in addition to the standard mixtures, an extra application or two of quick-acting nitrogen and may find that tree appearance is improved, but fruit quality reduced. The use of excessive amounts of nitrogen results in a coarse fruit. H. D. Young,* working at the California Experiment Station, has shown nitrogen to be a limiting factor in crop production, but on the soil worked with it produced an orange with a smaller percentage of sugar and with less juice.

Climatic conditions may influence the practice of an experienced grower who regularly uses a balanced mixture of nitrogen, phosphate and potash. If his trees are sluggish and appear underfed he applies additional nitrogen; on the other hand if the foliage appears unusually green, and the wood is soft, he applies additional potash. He strives to maintain a nutritional balance which will result in healthy trees capable of producing large yields and good fruit. Citrus production is not simple. Experience is costly. In the absence of scientific data, time and money can be saved by adopting the methods others have tested and proved with profit.

In reviewing the results of technical research, that of Reed and Haas* of the California Experiment Station should be noted. Their excellent researches on nutritional problems of orange trees have shown the effects of a deficiency or of an excess of potassium, sodium, calcium, and nitrogen in nutrient solutions resulting in an abnormal foliage and root development. Their technical work on the absorption of nutrients by citrus has extended our knowledge of problems in nutrition and of the feeding habits of the tree, but it is for the agronomist and the practical grower to work out fertilizer methods applicable to field conditions in Florida. Experiments with fertilizers which have been in progress at the Lake Alfred Experiment Station are yielding valuable results by demonstrating that certain nitrogen materials are best adapted to soil conditions prevailing in that section. In recent reports of R. W. Ruprecht,† results are given showing that the mineral nitrogenous fertilizers, sodium nitrate and sulphate of ammonia, gave as large yields of oranges and grapefruit as did organic nitrogen materials or mixtures of minerals and organics. It is stated that tree growth on all plots was the same.

Experiments are being conducted co-operatively by the Bureau of Chemistry and Soils and the Florida Station with fertilizers containing a number of synthetic salts in various combinations.

*H. D. Young, Effect of Fertilizers on the Composition and Quality of Oranges. Journal of Agricultural Research, Vol. 8, No. 4 (1917).

*H. S. Reed and A. R. C. Haas. Effect of Sodium Chloride and Calcium Chloride upon Growth and Composition of Young Orange Trees. University of California Publication; Agricultural Scientific Technical Paper, No. 4 (1923). Also Studies on the Effect of Sodium, Potassium and Calcium on Young Orange Trees ibid No. 11, (1923), and Absorption of Ions by Citrus and Walnut Seedlings; Hilgardia. Vol. 2, No. 4 (1926).

†R. W. Ruprecht. The New Idea in Citrus Fertilization. The Citrus Industry, Vol. 11-No. 9 (1930).

These experiments were begun in 1927 in a young Valencia grove near Lake Alfred. On the one hand eight fertilizer mixtures were used, each containing approximately sixty units of plant food, including nitrogen, phosphoric acid and potash made from chemicals such as ammonium phosphate, treble superphosphate, urea, ammonium nitrate, ammonium chloride, potassium ammonium phosphate, sodium nitrate, suphate of ammonia and potash salts. On the other hand fertilizer mixtures are used, containing approximately twenty units of plant food, made from superphosphate, sulphate of potash, sodium nitrate, sulphate of ammonia, fish scrap, tankage and blood. The effects of the concentrated fertilizers are compared with the effects of the old-line fertilizers on tree growth, fruit yield and quality, and shipping quality. Tree growth and fruit yield thus far compare favorably in the different plots. The grove is still young and so far the results obtained are not definite or conclusive. A study of the quality of the fruit was begun this season, and the results should be considered as preliminary. The fruits grown with the old-line fertilizers were slightly heavier and larger and after shipment withstood more pressure without crushing than those grown with most of the concentrated mixtures.

Shipment was made of two sets of seedling oranges this season from a grove near Orlando. For five years the grower had used concentrated pure salt fertilizer on one section of his grove, and on another section old-line materials, both receiving the same units of plant food. The oranges grown with the older fertilizer materials were six per cent heavier and larger than those grown with the concentrated fertilizers. The fruit grown with the older materials after shipment withstood more pressure without crushing than those grown with pure salt chemicals. These indicative results should be followed up with well controlled experiments on a number of soil types in the state.

Plans are being formulated for a few experiments with concentrated fertilizers, not merely to compare different sources of nitrogen but to study the effects of several combinations of synthetic and other chemicals, with the idea of developing a fertilizer mixture which will promote satisfactory growth and yield of quality fruit. Mixtures will be compounded, having a physiologically basic reaction, and others a physiologically acid reaction, and used with and without rare chemicals.

You are undoubtedly familiar with the effects of manganese sulphate on truck crops on the calcareous and non-acid soils of Florida. There are other unusual chemicals that have a stimulating effect on certain of these soils as remarkable as that of manganese. Some preliminary citrus experiments with manganese sulphate are in progress on acid and alkaline soils. On some soils there is an observable improvement from manganese in tree condition and fruit production. In other cases there was improvement in condition of growth in early spring, but this improved condition was not maintained throughout the summer.

In a grove at Sharpes, Florida, where the soil was slightly alkaline, having a pH of 7.4, manganese sulphate produced a larger and smoother orange. The oranges where manganese was used were five per cent larger and heavier than where no manganese was used. In a grove at New Smyrna, where the soil was slightly acid and having a pH of 6.0, the oranges grown where manganese was used were seven per cent larger than where no manganese was used. The production of fruit in both groves with and without manganese was about the same. After shipment the oranges in each grove grown with manganese required more pressure for crushing than those grown without manganese.

Extensive experimentation with uncommon elements likely to be deficient in Florida soils would seem of value and their use in conjunction with concentrated fertilizer mixtures having chemical reactions should prove a promising line of investigation.

In considering the fertilizer problem for Florida citrus soils the cover crop or green manure question and soil acidity or calcium deficiency should receive comment. The best fertilizer will fail to produce satisfactory results if used on land devoid of organic matter, or if used on land that is excessively acid or, occasionally, on land that may contain excessive amounts of lime. The growing of cover crops in Florida groves has

been widely discussed and their benefits demonstrated.

The subject of soil acidity and its relationship to citrus fruit production is a very interesting one. The importance of calcium for proper metabolism has been demonstrated by Reed and Haas. If deficient, leaf abnormalities develop, but on the other hand, excessive quantities are detrimental.

A number of years ago liming groves in Florida was a rather common practice. It took several years to realize that this practice was proving harmful on the light sandy soils of the ridge section. Objections to liming were pointed out by Floyd* while working at the Florida Station. The work of Burgess and Pohlman† in Arizona may shed some light on the problem. They have shown that excessive amounts of calcium carbonate caused injury and chlorosis but this condition was alleviated to a large extent by the incorporation of vegetative matter. The higher the organic matter of the sand the less sensitive was the plant to excessive lime application.

The physical characteristics of soils, drainage, and organic matter content are possible factors determining the influence of lime on citrus. Sections on the East Coast and the lower-lying heavy soil types of the citrus belt generally, may have a pH approaching neutrality or even alkalinity and yet maintain excellent groves while a similar soil reaction on the sandy Ridge belt may be unfavorable for tree growth.

The soils of the Ridge are variable in reaction as shown in the recent work of B. R. Fudge* of the State Citrus Experiment Station, whose researches contribute to the knowledge of the lime question.

Where it is deemed advisable to apply lime to citrus soils to control the reaction, small amounts used periodically to maintain a pH of 6.0 to 6.5 would seem preferable to a single application to accomplish this soil reaction. The question of whether added lime is beneficial as a result of correcting soil acidity or because it supplies available calcium to the trees should be given thought, and the possible deficiency of calcium in Florida soils should be considered when compounding concentrated chemical fertilizers.

These problems, including a study of the effects of such fertilizers, when reinforced with essential elements, are ones which we hope to study in experiments on soils of varying reactions and types.

Among the encouraging developments in the manufacture and use of chemical fertilizers may be noted the growing appreciation on the part of both the manufacturers and the growers of technical information pertaining to the use of chemicals for different crops, on different soils and under different climatic conditions.

*B. F. Floyd. Some Cases of Injury to Citrus Trees Apparently Induced by Ground Limestone. Florida Agricultural Experiment Station, Bul. 137 (1917).

†P. S. Burgess and G. G. Pohlman. Citrus Chlorosis as Affected by Irrigation and Fertilizer Treatment. Arizona Agricultural Experiment Station, Bul. 124 (1928).

*B. R. Fudge—Soil Acidity and Its Relation to Growth of Citrus. The Citrus Industry, Vol. 11, No. 9 (Sept., 1930).

THE IMPORTANCE OF CALCIUM IN CITRUS CULTURE

By Gray Singleton, Consulting Chemist, Ft. Meade, Fla.

For many years it has been noted by Florida citrus growers that the citrus fruit and citrus fruit trees grown in different parts of the State exhibit different characteristics. For instance, the fruit grown along the Indian River, in Dade County, certain sections of Manatee County and parts of Pinellas County is supposed to have a thinner skin and more juice per size than the fruit grown on the Norfolk sands of the Ridge section. It is also claimed by growers in the coastal sections that their fruit has a better color and higher aroma, or flavor, than fruit grown elsewhere.

There seems to be some basis of fact in the contentions of these growers as well as in the claims of the tangerine growers of the Brooks-

ville section and the pineapple growers of Marion County and parts of Lake County that their fruit takes on a deeper red color on maturity than fruit from other localities.

On investigating these claims we find that the rule does not hold good for any particular section but that it does hold on certain types of soil. In Marion, Lake and Pinellas we find that the fruit grown on Norfolk soil is no different from that grown on the same type of soil in any other part of the State, but the fruit grown on heavy "hammock" soil, overlying limestone, seems to be quite different.

It is important to note that all of these soils which yield a thin skinned, highly colored and highly flavored fruit are on a calcareous base rather than a sand base.

It has also been noted that fruit grown on soils with a limestone or shell base seems to mature earlier than the same varieties grown on sandy soils. In fact, before the advent of the arsenic spray, fruit from the calcareous soils matured several weeks ahead of fruit from the sandy sections.

Some years ago the growers noticed that fruit grown on sandy soil, but sprayed heavily with lime-sulphur, exhibited many of the characteristics of fruit grown on the limestone soils. Color and texture were better, the rind was thinner and the fruit matured earlier. This effect was generally attributed to the polysulphides of sulphur, but the fact was also noted that dusting with sulphur did not give the same results as spraying although the insecticidal effect seemed to be fully as good. It was unquestionably true that fruit heavily sprayed with lime-sulphur matured earlier, had better color and texture, a thinner peel and therefore more juice per size than fruit dusted. Some years ago the writer was employed by a group of large owners in the State to carry on systematic research work to explain, if possible, the differences noted and possibly to develop legitimate methods of producing a normal earlier maturity, thus lengthening the shipping season and getting away from the use of arsenic.

The first step was to vary the amounts of lime and sulphur in the spray. It was found that increasing or decreasing the sulphur made no difference, so far as could be determined, in the physical condition of either tree or fruit. On the other hand, increasing the lime content of the spray had a very marked effect, both on the tree and on the fruit. As soon as it was definitely ascertained that it was lime that was causing the desired effects a long series of experiments was started which have been running for six years. The work is far from being completed but the data secured warrants a preliminary report from which you can arrive at your own conclusions.

The first experiment was to take a number of trees and spray them with solutions containing varying amounts of lime and sulphur. This established the fact, as stated above, that it was lime that caused the difference. The next step was to take a number of trees and spray half of each tree with solutions of lime varying from none to fifty pounds of hydrated lime in two hundred galons of water. This was done about May first and in every case where more than two pounds of lime was used to two hundred gallons of water there was a marked improvement in the condition of both tree and fruit on the sprayed side as compared to the unsprayed part. The most striking difference was the dark green foliage and deeper colored fruit on the sprayed side while the foliage and fruit on the unsprayed side remained pale. On a number of trees it was noted that the sprayed side put on a flush of new growth and a few of them bloomed while the unsprayed side remained more dormant. This experiment was conducted in a grove that was not responding well to fertilization. It had been fertilized but the owner said that it was not "feeding well."

Another difference, which was entirely unexpected, was noted in this grove. The fruit and foliage on the unsprayed side of these trees showed much melanose. The sprayed side, where ten pounds or more of lime was used to two hundred gallons of water, showed practically no melanose on fruit or new growth. Careful examinations showed no damage to friendly fungi and no scale infestation followed. To check this observation three test plots were laid out. Plot No.

1, was sprayed with Bordeaux Mixture made from four pounds of bluestone and twelve pounds of lime to fifty gallons of water. Plot No. 2, had a Bordeaux made from four pounds of bluestone exactly neutralized with lime. Plot No. 3, was sprayed with twelve pounds of lime to fifty gallons of water. The remaining part of the grove was used as a check. The four plots, including the check, contained five acres each. The test was made on early grapefruit.

Plot No. 1, was severely damaged by scale in spite of three sprayings with oil and the copper persisted on the foliage for fifteen months.

Plot No. 2, was lightly infested with scale but this was controlled with one oil spray. Copper seemed to be gone in about three months.

Plot No. 3, showed no more scale than the unsprayed check, which was negligible.

Fruit and foliage on the three sprayed plots were practically free from melanose, while the check plot was damaged considerably, both as to fruit and foliage.

The physical condition of Plots 2 and 3, were about the same. Both showed a darker green than the check.

The next step was to take ten groves in one or more of which were planted practically all of the standard varieties of orange and grapefruit. These groves were sprayed twice, the first time in May and the second time in September. Each time ten pounds of lime was used in two hundred gallons of water. Seven of these ten groves showed markedly earlier maturity than normal. Seedling oranges gave practically the same analysis November 15th as unsprayed seedlings showed January 15th. There was no inhibition of acid formation as is the case with arsenic and the flavor, if anything, was actually better than normal fruit. Ten pounds was selected as the amount of lime to use because in some cases, where larger amounts were applied, the rind was so thin that serious splitting and creasing occurred and the fruit did not ship well. In no case was tree damage noted, even where fifty pounds of lime was used to two hundred gallons of water. Several of these groves had trees with typical cases of dieback. In all cases they seemed to be benefited and subsequent growth was well rounded and normal.

Juice measurements were made through the season on these ten groves and, on medium sized fruit, the increase, on both oranges and grapefruit, was from seven to nine per cent over fruit of the same size from unsprayed groves. Due to variations of seed content and thickness of rind no definite trend could be established on very small or very large sizes. In the early stages of maturity, both in orange and grapefruit, the increase in juice content was often twenty per cent over that of unsprayed fruit. Pineapple oranges did not react as well as seedling oranges except as to color of fruit.

It was noted in these experiments that Valencia oranges sprayed with lime do not turn green in spring and that they seem to remain on the tree much longer without drying. Tangerines and Temple oranges seemed to show the same tendency to hold juice later and tangerines showed a definite tendency to size up earlier in the fall. The color and texture in all oranges, tangerines and Temples was improved, but in some cases earlier maturity was not up to expectations. Later experimental work seems to show that deficiency in magnesium, or iron, or both, may affect maturity. Work along this line has not gone far enough to justify a definite statement.

It was known from previous experience that the application of lime directly to the soil would improve the appearance of the fruit, giving it a deep red color, but it was also known that this practice is dangerous to the trees.

Various combinations of lime were tried as fertilizers. Hardwood ashes and bone meal gave the characteristic dark green color to foliage if applied in considerable amounts. Calurea gave the same color and good results were gotten from a mixture of three hundred pounds of calcium cyanamid with one ton of pulp made from culled citrus fruit. This material is now being manufactured by a number of canneries from refuse. All of these materials seemed to improve the physical condition of the tree without the subsequent damage characteristic of direct applications of lime and all seemed to show a trend toward earlier maturity. The best results were gotten from

a combination of a lime-bearing fertilizer and a direct lime spray.

In order to cut down expense of spraying, experiments were made using a combination of the usual lime sulphur solution with added amounts of hydrated lime. The insecticidal value of the lime-sulphur solution seemed to be in no way diminished and the control of melanose was markedly improved. A number of experiments were tried on lemon scab but in all cases there was just as much scab on the sprayed as on the check plots.

Where calcium cyanide is used as a spray to kill Spanish Moss or prevent greasy melanose, lime may be added, but it is not recommended that it be used with oil emulsions or Bordeaux mixture. In some cases where lime, lime-sulphur solution and calcium cyanide have been used there seemed to be a definite killing of scale insects. This spray will burn young foliage and its use has not been sufficiently tested to warrant a definite statement as to what it will do. Cyanide, without lime, seems to have no effect on maturity. Lime alone seems to be definitely toxic to the Florida wax scale, even more deadly than oil emulsion but two applications are necessary, as the young under the old scale are not killed by the first application.

In summing up I would say that from what experimental work has been done it seems that lime can legitimately be used to lengthen the shipping season, both in fall and spring. It is markedly effective in causing early maturity in only about seventy per cent of the groves where it has been tried, and on lemon root and sandy soil it is not always effective in holding juice in tangerines and Temples. Its use is now standard practice on several thousand acres of groves and in all cases it has improved the color, texture and eating qualities of the fruit as well as giving a markedly beneficial reaction in the physical condition of the tree. The effect of lime is in no way similar to arsenic. It benefits both the tree and the fruit while a heavy spray of arsenic damages both and prevents the formation of acid and flavor. Lime is not nearly so effective as arsenic in getting fruit to pass the maturity test but the superiority of the fruit, especially oranges, and the benefit to the tree more than make up the difference.

This work was financed in part by Gentile Brothers of Orlando, but principally by Mr. L. Maxcy, of Frostproof, and Mr. Barnard Kilgore, of Clearwater, and is made public at the request of Honorable Nathan Mayo, Commissioner of Agriculture for Florida.

Dr. David Fairchild: I would like Mr. Singleton to state if he ever sprays with any other substance besides calcium or lime and sulphur in the Spring?

Grey Singleton: Experiments have been carried on with a wide variety of substances and combinations, but the best results that have been gotten come from the use of lime.

Dr. David Fairchild: What were some of those substances?

Grey Singleton: Iron, manganese, magnesium, and a combination of those elements.

Dr. David Fairchild: I would like to tell a story, Mr. President, in regard to this very interesting paper of Mr. Singleton's. I was in the Mediterranean district and stopped in to see the citrus collection at a famous garden. The manager told me the experience he had had in the spraying of citrus trees, and it was rather striking. I think you would be interested in it. When he took charge of this wonderful garden, which is the most famous garden on the Mediterranean, the authorities and pathologists had condemned the citrus collection of about seventy varieties of fruit, on account of the scale insects and citrus diseases, which were eating them up. The new owner of the garden inquired of his manager whom he had to take charge of the estate, what he had better do. The authorities had recommended that the citrus grove be destroyed. He said to the owner of the estate "If you will give me the money that it would cost to dig those citrus trees out I think I can cure them." I said "What did you do." He said "I laid out a pipe from the house sewer and put some spigots in the grove, and dressed up in slickers, and sprayed those trees with the sewerage water from the house." He said he immediately created a new

garden. All I can say is that I seldom have seen a more perfect grove than that which he had in this garden, and he had continued this process of spraying with sewerage water from the house. It was evident some of the applications were made, but it was rather an odorous process.

THE IMPORTANCE OF CERTAIN SPECIAL ELEMENTS IN THE AGRICULTURE OF SOUTH FLORIDA

By R. V. Allison, Everglades Experiment Station, Belle Glade

An inspection of the literature will indicate that during the past few years the question of the role of certain of the rarer elements in plant nutrition has come to occupy a place of increasing importance in many of the seminars and congresses of our own and other countries in which the more fundamental problems of plant development and reproduction are brought forward for serious thought and discussion. The workers of your Experiment Station here in Florida have contributed to this field in a number of ways and it is particularly on account of the almost paramount importance of some of these studies to the agriculture of South Florida that the present subject was suggested. Through the courtesy of your Secretary, provision has been made for the use of slides and a considerable number will be presented as this is by far the most satisfactory way of comprehensively displaying results of this kind.

The composition of the plant is of first importance from the standpoint of its usefulness in animal nutrition. Naturally, therefore, the unusual results that have been obtained in these investigations of the role of the rarer elements in the growth of higher plants have greatly stimulated, in turn, the investigation of the possible importance of these elements in the normal development and functioning of the many organs and parts of the animal body. Witness the unusually important work of McHargue in Kentucky who started out upon the investigations, in pure culture, and has continued on into animal nutrition with the use of plant material developed under such rigidly controlled conditions.

Likewise the current work of McGhee of Emory University, among many others, who is contributing importantly to the considerable amount of work that already has been done upon the role of certain metals in the maintenance of the hemoglobin content of the blood. His studies are largely based upon the use of milk that has been very carefully drawn and preserved from contact with metals in any form. He obtains remarkable results in the control of anemia by simply soaking alloys of certain of these metals in the milk to be used in feeding tests in comparison with untreated milk and finds that sufficient of the necessary ions go into solution to give very satisfactory regeneration of the hemoglobin and maintain normal health in the bodies of the animals involved. On the other hand, animals receiving a continuous diet of untreated milk rather rapidly became comatose and showed very little appetite. With the use of animals showing this latter condition for further study, however, it is found that after but four days upon a diet of the so-called "Metallized" milk they become quite normally active, play about freely and eat ravenously. In the course of eight weeks such animals have been observed to rise from below thirty-nine per cent hemoglobin to ninety-two per cent.

You will be interested in learning that the Experiment Station hopes to be able, in the near future, to announce the results of rather extensive studies upon what has been referred to as "Salt Sickness" that is found to be especially common among cattle upon the open range in certain sections of the State. The results of these studies to date have shown striking correlations between the use of certain of these metals referred and the correction of the disorder. In fact, it is this work in particular that has

prompted my present reference to the animal nutrition side of the general problem we have under discussion.

So much for the development of this important field of investigation that supplements plant physiological studies of the nature we wish to discuss here in such a remarkably interesting way. Sufficient has been said to indicate that this composition phase of the problem in relation to the ultimate utilization of plants and plant products, especially as food for living animals, constitutes one of the really important fields of research in animal nutrition.

BRIEF COMMENTS ON THE SOIL OF THE REGION

Before going into the matter of plant response to soil treatment it might be well to comment briefly upon the soils of the general region of South Florida, especially to the south and east where most of the work that will be referred to has been done. For this purpose the map of the Everglades Drainage District, Fig. 1, will be used. Upon this map the general location of the Everglades is well shown, likewise the fact of its base being constituted almost entirely of a calcareous formation of one kind or another. Thus, to the north the underlying material is designated as Caloosahatchee marl, partially consolidated and mostly in the soft rock stage. This is bordered to the south by a comparatively narrow zone of a medium hard phase of the same material which still further south passes into a really hard or silicious type. The underlying material along the greater part of the coastal area in this latitude is Miami Oolite, a comparatively soft and very porous type.

The greater part of the southern tip of the peninsula is covered with an extremely finely divided marl that varies in depth from a very thin layer or scum over the rock to a stratum three or more feet thick. This marl formation is thought largely to be derived from disintegrated shell and from the growth and decay of Chara and Blue-Green Algae. These marl deposits extend up the coast as seaward glades and represent many thousands of acres in the coastal area south of Miami. From the more or less landlocked areas of this type in the region south of Miami and east of Homestead the formation passes out into the broad, open marl flats characteristic of the region.

The natural rim of the Everglades to the east is made up largely of mineral soils that vary from a great variety of sandy types to the north to practically lime rock outcrop in the region south of Miami and on past Homestead along this low flat barrier. This type of rock outcrop continues on beyond the mainland in an interrupted fashion to form the Keys where, as in the Homestead area, the formation is characterized by the accumulation of small pockets of reddish brown to brown mineral soil that doubtless has been formed by weathering of the natural rock in place. This formation is very close to the red to reddish-brown lateritic types commonly found in Cuba and elsewhere in the tropics.

Upon the map of Figure 1 it is seen that practically all of the organic soils of the Everglades have been formed upon a lime base (or upon a comparatively thin stratum of sand over lime). This accounts readily for the essentially alkaline character of these soils in contrast with the acid properties that are so frequently attributed to them in popular reference.

In the matter of the progressive formation of the organic soils of the Everglades area, the more recent deposit farther to the south is represented by only a very thin layer of organic material over marl. In this region sawgrass is found growing very sparsely among small, weakly mangrove plants. This section, then, is the real frontier of the Everglades as it was originally advancing southwards down the peninsula. If the natural conditions of drainage of the entire region had remained unchanged, doubtless in some few thousands of years this section, as the land continues to rise, also would have become overlain with a heavier deposit of peat such as that which now is characteristic of the area farther to the north. As one passes north, then, this stratum of organic matter deepens until in the region of the lake it is twelve to fifteen feet, in places. Throughout this extensive stretch of marshland the profile is essentially one of pure sawgrass origin (though with low hammock growths locally interrupting

the type of formation in the southern sections) until the immediate lake region is reached. The depths of the deposit indicated upon the map shows a considerable area in the central glades where the formation is quite shallow.

In the immediate region of Lake Okeechobee the so-called "Custard Apple" soil (Okeechobee Muck) is found. This is a heavy, plastic type of formation that follows the shoreline of the lake rather closely. It represents a high grade of muck and contains, on the average, about fifty per cent of ash. The position of this belt of muckland, forming as it does a more or less natural levee about the southern and eastern shores of the lake is shown in an approximate way in Figure 2. The area of this type displayed on the map represents about twenty thousands of acres and refers to that profile only where the formation of plastic muck actually constitutes the surface soil. In the areas intermediate between the Okeechobee muck and the outlying sawgrass soil this plastic stratum is submerged and, in places, carries out into the glades to considerable distances in this lower position in the profile. Under these conditions the upper soil is a brown fibrous peat. The underlying material in the profile in all cases whether sawgrass, intermediate between sawgrass and muck or the high grade of Okeechobee muck itself, is a brown fibrous peat derived from sawgrass, frequently showing striking conditions of stratification.

Upon this same map the location of soundings are shown along lines of traverse which were made for the purpose of studying the variability of the soils of the Upper Glades and the elevation of the various strata making up their respective profiles.

It will not be possible here to go into the details either of the physical or chemical composition of the soils with which we are concerned in this discussion. The main point that it is desired to bring out in connection with these remarks is the highly alkaline character of many of the types we have to deal with in this section of the state. In the instance of the marls and of the red soils which are held in such intimate contact with the parent lime rock the source of the alkalinity is readily apparent. The reaction in the case of the organic soils, however, represents a balance between the natural acids of the organic components of the soil material and the lime of the soil waters brought up from the underlying rock or marl. On account of the chemical character of the reaction of the organic soils it is seen how it might vary somewhat from time to time, depending upon the direction of movement of the ground water.

Average values for the analyses of our sawgrass soils indicate that they contain about ten per cent inorganic materials and that about fifty per cent of this ash is lime (Calcium oxid). Thus it is seen that the lime content might be expected to range from three to five per cent (oven dry basis). The tendency of burning to greatly increase the alkalinity of this soil is readily understood, therefore, on account of this high content of calcium. The reaction values, expressed as pH, for unburned sawgrass soil is found to range from about 5.75 to 6.25 while that for burned soil, depending upon the freshness and severity of the burn commonly shows values higher than 7.0 and frequently as high as pH 8.0.

In contrast with the essentially alkaline character of most of our organic soils and others consisting largely of marl or those formed in intimate contact with the parent lime rock, some of the highlying sandy soils along the east ridge are comparatively acid in reaction as might be expected from the type and from their location in relation to drainage.

This emphasis is placed upon soil reaction particularly from the standpoint of growth response of plants to treatment of the soil with manganese. From the discussion that will follow it will be seen that this relation is very striking and that it is one that on account of the inherent character of our soils in South Florida, should receive very careful attention.

A BRIEF REVIEW OF WORK WITH SPECIAL ELEMENTS IN SOUTH FLORIDA UNDER VARIOUS SOIL CONDITIONS

On account of the limited amount of time that can be given to the discussion of this general field of work it will be based largely upon the series

of slides that follow. In this series reference will be made particularly to the work with copper, zinc and manganese upon our organic soils; also to that with manganese in particular upon certain of the mineral soils adjacent to the east coast, where unusual conditions of alkalinity are found to prevail locally. In addition to the facts of the various growth responses obtained through the application of such soil amendments as have been referred to, a limited amount of discussion will be given to the possible physiological background of some of them, particularly copper sulfate, and to certain aspects of their use in practice.

A. Copper Sulfate. The work with copper will first be discussed. The use of this element as a soil amendment has been found most particularly necessary upon the freshly broken fibrous soils of the Everglades that have been formed and, as all of you know, maintained under practically complete anaerobic conditions through submersion in water most of the year for many centuries right up to the time the program of drainage was inaugurated a few years ago. In areas nearer the lake where generally similar soil material has been exposed to somewhat better conditions of drainage for a number of years it is found that the chemical conditions of the soil has become so altered that there is no particular need for the treatment with copper in most cases. This is not only true of all of the high-lying "Okeechobee Muck" that has been referred to but to much of the area of intermediate soil lying between this and the outlying sawgrass soil that is commonly referred to as "Weed land" or "Elderberry land." This type is now referred to as "Okeelanta muck." Similarly, results have not been obtained with the use of copper sulfate upon the mineral soils referred to earlier as occupying the eastern and southern margins of the Everglades.

By way of review the nature of the response that has been obtained through treatment of our sawgrass soil with copper sulfate will be briefly discussed from the beginning; neither will reference be strictly to horticultural plants. When we come to consider responses in plants of the kind we have to deal with here, all have too much in common to require arbitrary division or individual grouping and treatment; likewise under such conditions the expression of carefully determined comparative yields are much reduced in significance when one side of the treatment produces only complete failure.

Slide 3 (269) in contrast with 4 (270) shows the striking failure of sugar cane variety Co. 281 upon sawgrass soil in the absence of treatment with copper; Slide 5 (265), however, does not indicate any great improvement in growth in the case of this particular plant through the inclusion of either manganese or zinc along with the copper. The characteristic type of top growth that appears in most varieties of sugar cane in consequence of lack of copper under certain soil conditions is well shown in Slide 6 (198) which happens to be growing upon a freshly broken mucky sand. This growth is considerably heavier than would be expected upon untreated sawgrass soil but the drooping habit and failure of the leaves to unroll is very characteristic, especially of the heavier type of cane. This variety is Crystalina. A further striking effect of lack of copper in situations where it is needed appears in the color of the foliage. Commonly it becomes very light green to almost yellow before the leaves die. In the case of sugar cane the leaves of some varieties show striking conditions of mottling that frequently resemble very closely the appearance of mosaic.

Slides 7 (723) and 8 (724) show the appearance of leaves of an Indian cane Co. 281 as affected in this way by copper deficiency and mosaic respectively. When compared side by side it is seen that the light spots of the mosaic pattern are much less sharp than the more blotchy type created by the absence of treatment of copper referred to. It is of interest to note, however, that analysis of these leaves for copper has not shown consistent differences in their content of this element in comparison with that of normal green leaves.

In respect to the recovery of plants suffering from lack of copper, very striking results have been obtained. Slide 9 (600) shows a stool of Crystalina cane several months after it had been removed from a check plot in the field when it

was about eight months of age. Little real improvement in growth followed its removal to the greenhouse culture shown in the slide. Slide No. 10 (599) on the other hand, shows a similar stool of cane that received a few grams of copper sulfate in the soil at the time it was placed in the greenhouse culture. Note how the original stem, (No. 1), has expanded in diameter and the internodes lengthened above in the newer growth that followed—also the greater size and vigor of the new growth that has appeared. The contrasting appearance of plant development in the field under such conditions of treatment is very striking. Slide No. 11 (?) represents an air view of a large fertilizer experiment carried out at Canal Point in co-operation with the Southern Sugar Co. and with the Wilson and Toomer Fertilizer Co. and Potash Syndicate. The plots established were one acre in size and the series represented a considerable number of different fertilizer treatments. Among the treatments were those involving no inclusion of copper sulfate and these plots are distinctly evident in the photograph through complete failure to produce any growth of cane whatsoever. In a similar way Slide No. 12 (89) shows failure in peanuts upon sawgrass soil through lack of treatment with copper. The central plot in the foreground received a series of four materials including zinc sulfate and manganese sulfate, but no copper, while that to the right received copper in addition to this treatment. The central plot in the background is a complete check having received no soil treatment whatsoever.

Results with tree plantings that have been obtained upon our sawgrass muck at the Experiment Station during the past year may be of particular interest at the present time. In contrasting check and treated plantings reference is to those receiving no treatment in comparison with those receiving a general soil treatment involving copper, manganese phosphoric acid and potash. A considerable number of varieties on different stocks were planted but from among these the following will be shown to indicate the unusual effect of the treatment which, doubtless, was largely due to copper sulfate.

SLIDE SERIES 12-A

Slide No.	Variety	Treatment	Root Stock
12A-1 (725)-3	Duncan Grapefruit	treated	Rough lemon
-2 -21	Duncan Grapefruit	untreated	Rough lemon
-3 (725)-2	Pineapple orange	treated	C. trifoliata
-4 -9	Pineapple orange	treated	R. Lemon
-5 -5	Pineapple orange	treated	S. Orange
-6 -23	Pineapple orange	untreated	S. Orange
-7 (725)-6	Tangerine Dancy	treated	
-8 -26	Tangerine Dancy	check	
-9 (725)-33	Avocado Collinson	treated	
-10 -13	Avocado Collinson	check	
-11 (725)-28	Peach Jewel	treated	
-12 -16	Peach Jewel	check	
-13 (725)-29	Tungoil	treated	
-14 -17	Tungoil	check	

RESIDUAL OR CARRYOVER RELATIONS

Among the first questions asked in connection with the use of copper sulfate as a soil amendment are in regard to the residual or carry-over value of the treatment. The carry-over of the treatment from season to season appears to be very definite and should be given good consideration in the further treatment of the land. Slides

Nos. 13 and 14 (73 and 74) represent a second planting of corn and sorghum, respectively, in the old lines of treatment upon plots that had been treated for the first time along with the immediately previous planting without further applications to the soil in contrast with repetition of the planting upon the check plots. The response here shown appears even better than in the earlier planting and this is found to hold true under field conditions, especially where care is used in obtaining uniform distribution of the material.

In a general way fifty to seventy-five pounds of bluestone commonly are applied at the time of the first breaking. In order to overcome irregularities in application, the possibility of bringing up fresh, untreated soil, etc., it is believed a desirable practice to retreat with copper in future applications in such a way that the quantity is reduced by one-half each time until the fourth year when an eighth is again applied and in this way the original treatment repeated in the course of four years. This would involve a half quantity the first year of reapplication, a quarter quantity the second and an eighth quantity on both the third and fourth years. This practice is being adopted in some of our series of fertilizer plots where general treatment of copper is desired without further study in detail.

THE BACKGROUND OF THE RESPONSE

Frequent questions also are asked in regard to the background of this favorable action of copper, whether it is physical, chemical or bacteriological in character or whether its first relation is to the plant or to the soil. Opportunity has been found to check up some of the earlier observations upon the relation of the plant to the treatment, and the further the study is carried the more it becomes apparent that we have here a biochemical problem involving in a rather intimate way at once the physiology of the plant and the chemistry of the soils involved. Thus Slide 15 (111) shows the recurrence of plant response through planting beggarweed in the old line of treatments as well as complete failure of plants seeded between these rows upon the same date. Slide 16 (112) shows the response of similar plantings of these same rows across the check plot where it is seen that all rows have failed. So it is apparent from the first slide that plants actually fail in soil that is filled with living roots developed by other plants that have contact with the element at some point. The manner in which plants fill the space between rows with roots is shown in Slide 7 (53). Rape plants are involved here where, as in the beggarweed planting, treatment was only in the line of planting. Still the roots far out and down in untreated raw, sawgrass soil were entirely normal and vigorous in their development in zones of the soil environment entirely untouched and unaffected by the treatment.

From the fact of growth responses of this type in relation to the soil treatment it would appear that the beneficial effect of the treatment upon the plant is one of protection against some one or more of several possible toxic components that may occur in such a soil and that, furthermore, the protective action comes, or at least may come, from within the plant following the actual assimilation of the copper ion into its system. In connection with such an hypothesis, however, it is to be repeated that favorable response has not always been accompanied by consistant increase in the copper content of the plants showing the more favorable growth.

The matter of obtaining these plant responses by treatment with copper independent of direct contact of the element with the soil was suggested by these observations and was undertaken as early as 1927 through insertion of Bordeaux mixture into stems of cane used as seed pieces and then carefully sealing the opening made for this purpose. Definite response was obtained in this way at that time and in a number of similar ways subsequently. Thus in Slide 18 (557) two large box cultures containing untreated sawgrass soil are shown in which sugarcane (Co. 281) is growing. The box on the left was planted with cut pieces of cane in the regular way. That on the right has its plants growing from stems that have been layered and so maintain their connection with the parent culture to the right wherein the soil is well treated with copper. The difference in growth here is very striking, though unfortunately with the isolation of this soil from its natural en-

vironment in this way, the factor responsible for the reduced growth or injury to growth seems gradually to become dissipated so that the unusual differences that are at first very striking gradually become less apparent. It was from the box on the left that the leaves were obtained which were shown in Slide No. 7 as representative of the effect of absence of copper treatment upon leaf color under such conditions.

RESULTS WITH ZINC SULFATE

Before going into the work with manganese sulfate certain interesting results with the use of zinc will be briefly referred to that have been obtained in conjunction with the copper treatment upon our raw sawgrass soil, to which these particular studies have been largely limited.

In connection with the use of zinc sulfate under these conditions it is first to be emphasized that we have never at any time obtained anything of a permanently favorable result with its use alone. However, in comparative observations upon the value of independent treatments with copper and zinc sulfates upon the peanut plant it was found that while the former used alone finally gave very favorable results, there was a considerable delay, involving some six weeks or more during which time the plants suffered quite as much as on the check or untreated plots, and in fact nearly die while in this stage. This condition is well shown in the plants of Slide No. 19 (242). At the time this photo was taken the plants were a little more than a month from time of seeding and are well into the stage of injury indicated by the yellowing and spotting of the leaves and non-appearance of new growth. One of these plants is shown as a close up in Slide No. 20 (258) in which the conditions referred to are made more apparent. Later such plants at the age of seven or eight weeks were observed to put out splendid green growth and continue on to maturity in a normal way. With the use of zinc sulfate alone, on the other hand, quite an early response was obtained that was rather more spindling than normal, but nevertheless was decidedly apparent. The contrasting character of these responses, especially in relation to the time of their appearance, suggested the desirability of applying the two metals in combination. This was done and with most extraordinary results when planting was made upon freshly broken sawgrass soil shortly following the application of the treatments. For a comparison of the results Slide 21 (246) was prepared to show the effect of including zinc with the copper for soil treatment under such conditions of planting. The plants are found to be normal in every way both in growth and color. No loss of time was experienced at any period in the development of the plants upon this treatment and in consequence at the time of maturity of those plants receiving this combination treatment were six weeks ahead of those receiving copper only. The plants of the latter treatment were still in full vegetative vigor, in fact, as is well shown in Slide No. 22 (120). Here the group on the left received no treatment, those in the center received the combined treatment of the two elements while those on the right received copper only.

The tendency of the zinc to promote earliness of development when combined with the copper treatment in this way is well shown in the Table of Slide 23 where even upon the later date of harvest the difference was still very pronounced. On account of this pronounced response to zinc under such conditions of combination with copper and time of treatment in relation to planting it will be exceedingly important, under carefully controlled conditions, to ascertain whether its presence is still of significant value after the copper treatment has become thoroughly established in the soil as residual from earlier treatments.

Effect of treatment of sawgrass peat with copper and zinc on the comparative development and yield of peanuts and the time of their maturity:

Chemical Treatments Involved	Harvest I (87 days)		Harvest II (102 days)	
	Relative Yield	% Sound Peanuts	Relative Yield	% Sound Peanuts
Check	—°	—	—°	—
Zinc (only)	—°	—	—°	—
Copper (only)	100	47.5	100	61.2
Copper and Zinc	267	80.6	129	81.5

(°) No development or yield.

THE IMPORTANT DEVELOPMENT OF THE USE OF MANAGANESE AS A SOIL AMENDMENT IN SOUTH FLORIDA

In contrast with the use of copper which has been observed to give important results on raw, organic soils whether acid, neutral or slightly alkaline in reaction, results are scarcely ever obtained with soluble salts of manganese upon soils more acid than pH 5.5 to 6.0. This is frequently found to vary considerably, however, with different soil conditions. Certain it is that within practical limits the more alkaline the soil the more pressing the need usually appears for treatment with manganese or with some materials which will produce reaction changes in the soil mass of such a character, such as sulfur, that it will be instrumental in rendering available the manganese already present.

The first results obtained with manganese upon the organic soils of the Everglades were published in Bulletin No. 190. Slides 24 (19) and 25 (43) show as the second treatment in each case the results of these early studies with the use of manganese alone on radishes and beets upon unburned sawgrass soil. Investigations were started shortly thereafter, however, upon the more alkaline soils in the region nearer the lake that were brought to this condition largely by burning.

At about this same time the Office of Soil Fertility of the Bureau of Chemistry and Soils started a series of co-operative tests with the Florida Experiment Station upon the marls of South Florida in the region between Miami and Homestead that centered largely about the use of manganese upon tomatoes. In this work, published as Bulletin No. 218 of the Florida Experiment Station unusually important results were obtained and subsequently the use of manganese as a soil amendment in this section has been extended to a considerable number of other crops where soils of this type are involved.

Although some results have been obtained with the use of manganese upon our natural sawgrass soils in the Everglades that do not contain more or less of an ash accumulation in consequence of earlier burning, it is particularly upon those that have had their reaction changed somewhat through such an experience or otherwise as by marl from canal banks, etc., that the most important need for it arises. Slide No. 26 (251) shows a general view of a complete corn failure upon an area where the muck had been burned rather seriously some time prior to the planting.

The fact that beans are particularly sensitive to such deficiencies of manganese as are brought about by such conditions of excessive alkalinity in the soil made this plant first responsible for bringing the seriousness of the burning of the soil in the lake region to our attention. By 1927 the failure of beans over considerable areas of the most valuable land in the Upper Glades was beginning to cause real concern. In the Autumn of that year trials were laid out with a large number of individual materials upon an area in the Pahokee region where the conditions of failure were exceptionally acute. From among the large number of materials tested, sulfur and manganese sulfate applications in the soil were decidedly outstanding. Slide No. 27 (94) shows in an exact way the character of the response obtained with the treatment of the soil with manganese sulfate in these early tests; the treatments left to right are:

1. Copper sulfate.
2. Copper sulfate with phosphoric acid and and potash.
3. As No. 2 with manganese sulfate added.
4. Copper sulfate and zinc sulfate.

The response of beans to the manganese treatment under these conditions was very outstanding and similar results were obtained in other areas extending all the way around the lake to Moore Haven where this type of trouble also had

been experienced. It is largely upon the basis of these results that the widespread use of manganese in the Upper Glades has developed. In the case of this particular plant important results rather promptly have also been obtained with the use of superphosphate.

The fact of the occurrence of these results under field conditions with the use of other plants as well as beans has been strengthened by a considerable amount of greenhouse work carried out along the same line. The next three slides show the benefit derived from treatments upon a bean-sick soil under greenhouse conditions taken from the Pahokee area referred to. Slide No. 28 (284) Bountiful beans, shows:

Left, Treatment with sulfur.

Right, No treatment.

The treatment with sulfur has had a very pronounced effect in increasing the acidity of the soil and so rendering available in this way the store of manganese already present in the soil to the use of the plant. Slide No. 29 (285) Bountiful Beans, shows:

Left, Treatment with sulfur only.

Right, Treatment with sulfur and superphosphate.

Here a rather marked depressing effect of the superphosphate is to be observed upon both the color of the foliage and the development of the plants. Slide No. 30 (288) Bountiful beans, shows:

Left, Check (No treatment).

Center, Superphosphate.

Right, Manganese sulfate and superphosphate.

It is seen that the superphosphate has produced a considerable response over the check cultures but the manganese sulfate has greatly improved the color and development of the plants where applied in addition to the superphosphate.

Slide No. 31 (442) shows the positive value of manganese and the entire failure of copper sulfate in the correction of this condition of sterility of burned soil for sunflowers. The soils for these tests was obtained from a rather lightly burned area along the north side of the Experiment Station property adjacent to the Hillsboro canal. Here the reaction value commonly exceeds pH 7.0 and rather frequently is found to be as high as 7.5. Left to right the treatments are:

1. Check.
2. Copper sulfate.
3. Manganese sulfate.
4. Copper and manganese sulfates.

By way of contrasting these results obtained in the greenhouse with those obtained in the field upon the same soil the next four slides will show the same four treatments applied under the latter condition.

Slide No. 32 (471) Check:

Slide No. 33 (464) Copper sulfate.

Slide No. 34 (469) Manganese sulfate

Slide No. 35 (467) Copper and manganese sulfates.

While the manganese alone has produced very good results under field conditions, it is seen that the inclusion of copper sulfate greatly improved its action. The combination of the two under this particular condition in the field producing much better results than the use of either alone.

In this same series, in fact on the opposite side of the same 200-foot section of land, the same treatments were extended over practically normal sawgrass soil free from earlier burning and the results are shown in the following slides:

Slide No. 36 (481) Check.

Slide No. 37 (485) Copper sulfate.

Slide No. 38 (474) Manganese sulfate.

Slide No. 39 (477) Manganese and copper.

In the results of these treatments upon undisturbed sawgrass soil it is seen that the use of copper become much more important and the manganese less important though the combination of the two still produces the best results by a considerable margin.

Upon this same area of abnormally alkaline soil at the Experiment Station the first beneficial results from the use of manganese sulfate upon sugar cane were observed in 1929 and these helped greatly in the prompt interpretation of a serious cane failure elsewhere in the area that followed an extensive planting upon an area where the soil, earlier, had been seriously burned.

Slide No. 40 (491) No treatment with special elements.

Cane Varieties, left-right:

1. POJ.36.
2. POJ.36-M.
3. S.C.12-4.

Slide No. 41 (488), Treatment with copper and manganese sulfates.

Cane Varieties, left-right:

1. POJ.36.
2. POJ.36-M.
3. S.C.12-4.

Comparison of these results with the plots receiving the copper treatment showed that, as in the case of the sunflowers, the improved growth resulting from the combined application of the two elements upon this area is largely due to the manganese involved in the treatment.

As the final slides to be shown upon the work that has been done with manganese I wish to refer further to the rather extensive failure of the cane plantings that were made upon the deeply burned soil referred to above. A series of tests was laid out upon this area with sugar cane that involved not only two different rates of manganese applications but soil treatment with sulfur and sulfuric acid as well (The latter as equivalent sulfur to the former).

It is of particular interest to note that this soil has been so severely burned that treatment with manganese sulfate at the rate of seventy-five pounds per acre or even twice this application has failed to produce practical results. The use of sulfur at the rate of two or three hundreds of pounds per acre applied in the furrow at the time of planting has produced good results, however, while sulfuric acid applied in the same way has done even better. Slide No. 42 (672) shows the development of the first ratoon of variety Co. 281 upon the check plot of the series by mid-November. Slide No. 43 (673) shows the development of the same variety of cane upon the plot receiving treatment with sulfuric acid. This is to be compared with the development of the cane upon the previous treatment, directly, in order to understand the important changes the treatment with acid has brought about in the soil.

It is a particularly striking fact that while both sulfur and sulfuric acid were instrumental in reducing the alkalinity of this soil for a time, it rather soon returned to its original level. Nevertheless practically normal cane was produced upon these plots as a plant crop and they came through with an equally good or even better growth with the first ratoon crop without further treatment of the soil. At the present time they have been harvested and a wonderfully vigorous second ratoon growth is appearing again upon those plots that have received treatment with sulfur or sulfuric acid though the reaction of the soil, as noted, has again become decidedly alkaline.

This particular point brought out in connection with sugar cane might be of especial interest to citrus growers upon areas where the color of the foliage and development of the trees seems to be affected by excesses of lime in the soil. Tests with manganese and other materials that are in progress upon a small grove of citrus in the Davie area are showing rather striking appearances of benefit at the present time. Here, marly conditions of the subsoil occur that frequently appear as outcrops at the surface and have produced severe conditions of frenching and chlorosis of the leaves upon a considerable number of trees. On account of the permanence and strength of the established root systems of such plants as citrus trees it is thought that it might be possible, as in the case of sugar cane under similar conditions, to make rather less frequent applications of such soil amendments than might be found necessary in the case of annual plants that have first to establish new underground parts with the development of each year's growth.

On account of the prospective need for rather consistent use of copper and manganese in a considerable part of our fertilizer mixtures in South Florida in the future the thought arises whether that it might not be well to include the two metals in the formula in the fourth and fifth places in a systematic way. It is believed that this would be a good practice and helpful to the manufacturer as well as to the consumer in a number of ways.

This has been the practice in the work at the Experiment Station for some time and it has been found a decided convenience in the matter of manipulation of the treatments and keeping of records. When used in this way the soluble sulfates of both metals should be understood and cal-

culations based upon the weight of the metals themselves rather than their oxids. Thus one of the mixtures that has been prepared for general treatment of the soil over a general series of replicated tests involving different sugar cane varieties is O-8-24-4-2, the fourth and fifth places being given to copper and manganese, respectively. It is believed that those interested in bringing mixed goods that involve these special elements into the region will do well to consider this proposition both for their own convenience and protection as well as that of the consumer.

If I were permitted the privilege of a further suggestion in connection with the use of amendments of the type we have been discussing here, which, under the circumstances, seem to force production from the soil against its will, as it were, it would be the use of great caution against overdraining the soil of the more common elements of fertility by such means. A couple of slides in this connection will tell the story much more clearly and forcefully than I can. Slides No. 44 and 45 (692 and 693) show the effect of continuous cropping of the soil with the use of complete treatment of copper, manganese and zinc but no nitrogen, phosphoric acid or potash in the former while the latter has had exactly the same series of croppings and treatments except that potash was included in the treatment which was otherwise the same. The difference, then, is potash, though the results shown in the photos is to residual potash remaining in the soil after two crops of peanuts had been removed subsequent to the last treatment which the soil had received. The effect is quite as striking as the much discussed copper response ever has been, representing, as it does, the difference between satisfactory growth on the one hand and complete failure on the other.

Dr. David Fairchild: I would like to say a word about this remarkable paper of Mr. Allison's. I have followed the work of Mr. Allison for a number of years, and it strikes me that this paper that we have listened to is an epoch making announcement of something that's coming, in plant physiology, that I suppose many of us don't realize. It may interest you to know, and many of you perhaps do know, that Mr. Kettering of the General Motors has established a research garden at Antioch, and is working on the photosynthesis of chlorophyll. There is a chemical mind that's worth considering, when you recall he revolutionized the motor fuel proposition by introducing lead acetate, and it was illuminating to listen to his consideration of the difficulties in the performance of chlorophyll. The problem which Mr. Allison has propounded to us of the influence of these small quantities of the heavier metals is one that we think you will all — the younger ones of you at least — see take the center of the stage, to a degree that few of us, who have been accustomed to looking upon the plant as only a root crop, with something green in the air, instead of a sun machine working through the sun, realize. I think many of us will come to see a more or less revolutionary turn-over in this problem.

I think this paper of Mr. Allison's is a very remarkable announcement of the policy that has to be considered very seriously by citrus growers and in particular those who are going to grow plants.

A. W. Garnett, Hypoluxo: I live ten miles south of West Palm Beach. I would like to ask Mr. Allison if he has ever noticed any damage to peppers and other plants from having too much manganese in the soil the year before.

R. V. Allison: The tendency toward injury, particularly from copper and on muck soils, would depend on the type of soil you are working on. In our case, in muck soils, we have never observed definite injury from the use of an excess of these on account of the nature of the soil. We have had applications running up as high as 10,000 pounds per acre, which has produced some damage, but that is way beyond what would be used by you. We tried to get the maximum application, but in your case, near Hypoluxo, you are probably working on sand and muck mixed, and it would be much easier to reach damaging applications on soil of that type, especially if at all acid. But there, again, before the applications are made, it would be easy to have a test made in the laboratory to see whether there is much prospect of getting an excess. Reaction of the

soil is very easily studied, and I think growers should have a definite knowledge from what we have said, especially of the reaction of the soil. If we know the reaction in terms of pH we can give you rather definite advice.

A. W. Garnett, Hypoluxo: I would like to ask this: Mr. DeBusk and Mr. Nettles were in my grove, and helped superintend the erecting of the trees following the storm. We have since planted trees in lands adjoining, and found it has hardpan, of chocolate color or brown color, about three and one half or four feet, and the soil turns dark a foot below. I don't know what to do with the trees or how to fix the land so it will make citrus. It is adjoining a grove forty years old, that has yellow soil, gopher sand. This land was once subject to overflow, but since the Lake Worth drainage has lowered the water level six feet it is not subject to overflow, but there is a somewhat acid condition there yet. I would like to know if anyone can tell me whether I can grow trees on this land.

R. V. Allison: What is the type of material lying directly beneath the hardpan?

A. W. Garnett: It runs off in fine, white sand.

R. V. Allison: It seems as if it is a problem of water manipulation, and by deep knifing, you could break up the hard pan. If you want to break it up, you can get free drainage by the use of special tools that will go down thirty inches under the glades, I believe.

A. W. Garnett: Thirty inches won't reach most of it.

R. V. Allison: What's the depth of the bottom?

A. W. Garnett: It would require four and one half feet to go all the way through; the water level is somethimes below, sometimes above.

R. V. Allison: With the establishment of drainage by other means, it is entirely possible, by keeping the water table down, and exposing its stratum to leeching you do away with a good bit of it.

A. W. Garnett: It has been suggested, and I have read you can treat such land with dynamite. Would a hole under each tree be sufficient?

R. V. Allison: I should think so.

L. B. Skinner: Use 20c dynamite and half a stick to the tree.

Mr. S. F. Poole: Mr. Skinner says use 20c dynamite.

Mr. L. B. Skinner: Twenty cent don't blow up like 50c. It just breaks the soil.

CITRUS GROVE PRACTICE ON THE HIGH PINE LANDS

By N. H. Vissering of Babson Park, Fla.

Mr. Chairman and fellew Members of the Horticultural Society: I deem it a great honor to be called to deliver a paper at this meeting. The subject assigned to me was Citrus Grove Practices on the High Pine Lands of Florida. In the following pages I have endeavored to outline the trend of grove practices on these lands. I have also taken the liberty of setting forth a few of my own theories and experiences.

Grove practices on the high pine lands are undergoing very radical changes. Progressive growers are continually searching for new ways by which they can cut their production costs and still raise larger crops of high quality fruit. Anyone who keeps an accurate record of production costs will readily note that there are two major cost items: namely, fertilizer and labor. If any substantial savings are to be made in the cost of production these two accounts are the logical ones to examine first.

Let us consider first the fertilizer item. There is a growing tendency to use materials instead of mixed goods. Apparently satisfactory results have been received by cutting the amount of phosphoric acid used and applying this material once a year. Many growers are also applying all their potash in one or two applications, using either muriate or sulphate. I am not prepared to say,

however, that satisfactory results have been received by reducing the amounts of potash applied. There is also a tendency to turn from the use of the expensive organic sources of nitrogen to the cheaper chemicals. It has been quite conclusively proven that quality fruit can be grown with these cheaper fertilizers providing the grower uses intelligence in their application and the rest of his grove practice.

For the grower who intends to cut his costs by using chemical ammoniates, I have several recommendations to make. First and most important he should either supervise the fertilization of each tree personally or have this done by someone whose judgment can be relied upon. Most of these chemicals are very high in analysis and are not fool proof. There was very little temptation for a man to overfertilize a tree by the old method, because that meant real work but with these new high powered products mistakes are so easily made. My second recommendation is that the grower increase the number of applications of ammonia made during the year. This will prevent leaching, reduce the possibility of mistakes and provide a more uniform supply of plant food which is essential in the pursuit of quality. Third, he should insist upon even distribution; and fourth if the organic matter is left out of the fertilizer bag it should be applied through some other means. Cover crops are the cheapest source and too much can not be said of their importance. Crotalaria spectabilis appears to be the most desirable crop to use because it does not encourage pumpkin bugs; yields a large amount of organic matter, and is easily disposed of in the fall. On land that does not grow good cover crops it might be economy to haul in some cheap organic material. I have on my grove at present a large pile of muck which I have been composting with manure for some time preparatory to applying it to such land.

Many growers are also becoming aware of the important part played by a number of the so-called secondary elements in the diet of their trees. A deficiency of calcium is probably easier to notice in a grove than a shortage of any of these plant foods. Following Professor Lord's address at the annual meeting of this society in Sebring a number of growers, myself included, experimented with Calcium Nitrate as a quickly available source of calcium. This material has proven very efficient in eliminating a type of Frenching, very common in the Ridge section.

Next to the change in fertilizer practice probably the most radical change to be noted is in the practice of cultivation. Growers are abandoning the wasteful habit of frequent cultivation. They will probably only do enough in the future to prevent damage from fires and frost. The old theory of the advisability of a dust mulch seems to be exploded. Several winters ago I was making some tests on winter cover crops in my grove. This happened to be a very dry winter. Everyone in our section was hauling water to their groves to revive wilted trees. It was very interesting to note that I had fewer trees suffering from drought in the areas where I had a good winter cover crop growing than in the clean cultivated areas. I might also add that the quality of the fruit in the uncultivated areas was also infinitely better.

Hoeing is still general practice but it seems quite likely that this may be omitted in the future.

The aforementioned changes may be made by any grower, regardless of his acreage. Further reduction in grove expense must come from savings made possible by large scale production. Many men have known the facts which I am about to state but have refrained from discussing them publicly because of the possible effect they might have on real estate values. This season we have come face to face with the common problem of practically all American industries: over production and yet the present crop will soon be dwarfed by what we will produce in the very near future. According to the United States Department of Agriculture we will soon be confronted with the problem of marketing twenty-three million boxes of American grapefruit while the most we have ever profitably marketed has been nine million boxes. To meet this keen competition very radical changes will have to be made both in our production and marketing systems. The inevitable results will be the same in our citrus industry as it has been in other great industries—combination. The grower who lives in Florida can avail himself to a considerable degree of the benefits of large scale production by co-

operating with his neighbors in buying materials and joint ownership of equipment. However, I believe that the stage is set for the advent of a relatively new unit, the Citrus Corporation. Instead of groves in the future being owned by absentee owners and operated by caretakers I look for them to be owned and operated by large corporations, who will be in a position to avail themselves of all the benefits of large scale production.

I hope that these remarks will not class me as an alarmist. I have every reason to believe that the citrus industry of the Ridge section and the state as a whole will survive the competition but I also believe that the time has come when the individual grove owner will have to really run his business and take advantage of all possible savings if he wants to show a profit from his operations five years hence.

I also hope that I will not be taken too literally when I advocate reducing costs. I honestly believe that the observations I have made earlier in this paper can be followed to the benefit of the fruit as well as the pocketbook. I am not prepared, however, to go as far as some of our more radical cost cutters and say that we can do away with our spraying and pruning. I know that a certain amount of both is essential. The day may come when the bulk of Florida's crop will move forward in cans or as juice but until then I do not feel that the grower can afford to neglect the appearance of his fruit in his newly awakened interest in economy.

Mr. Vissering: Perhaps I ought to qualify a few of my remarks in regard to the chemical fertilizers. Please note that I stated if a man left organics out of his fertilizer, he should apply them by some other means. I think very few groves in Florida, especially in the high pine lands, have sufficient organic accumulation in them at present that they can abandon consideration of organics. A great deal has been said by various experts about the advisability of turning to the chemical mixtures. After talking to a number of growers who have attended these meetings, I am afraid there is a little misconception among them. They are apt to take the speaker too literally and interpret the quality of fruit grown by strikingly inorganic diet, regardless of what source of inorganic is used. The gentlemen who received these good results understood their application. They knew the difference between one chemical fertilizer and another, and when one should be used, and how much. I realize many of our growers have this information at their finger tips, but it seems to me that a dose has been prescribed for them and yet the directions for taking were not quite clear.

If this adaptation is going to increase, as it seems certain it will, the quality of the fruit in the future will be even more important than in the past. Before growers dive into an inorganic source I think they should consider their own problem very carefully first—find out the nitrifying power of their soil, and how much humus it contains, and so on, and consider that before they sacrifice their quality.

Mr. Hammerstein, Hollywood: I would like to ask Mr. Vissering to go further into detail about hoeing.

Mr. Vissering: I might state that's rather a new idea to me personally. I have always practiced hoeing in my own groves. However, this season I neglected to hoe certain blocks in my grove accidentally, and I can't see but what they set as good a crop and that the quality of the crop left on the trees, if anything, was a little better fruit, and I know I saved five or six cents a tree on them, which at the present time is a considerable saving over a large acreage. I don't see, unless you want to sell the grove, why we can't abandon the practice.

Mr. Hammerstein: Would you suggest you continue this practice on that certain block of trees for the next year or so, as an expert?

Mr. Vissering: That suggestion was made by some men whom I think know their business fairly well. It seems like a lot of merit to it, especially on early varieties. As soon as you have pickers, they will do the work and not charge you anything. Perhaps on your late Valencias, if you are afraid of damage by frost, by having that stuff in there, you might go ahead removing it.

CITRUS GROVE PRACTICES ON THE HAMMOCK LANDS OF THE INDIAN RIVER SECTION

By L. R. Highfill, Cocoa, Fla.

The subject allotted to me is one that might extend through hours of discussion, and permit a range of thought that would carry us into a multitude of subdivisions of each phase of it, and into an elaborate discussion involving experiences of growers for the past fifty years; and the theories of scientists and investigators and experts some of whose conclusions will stand until a new theory is evolved. All of this would be of no great value at this time. What I propose to bring to you is just a few minutes of a summary of my personal observations as a layman, who has lived and worked in the groves of this entire area for a period of twelve years. It has been my privilege during this time to observe, advise and direct the cultivation and fertilizing of hammock groves, from the North to the South end of this area known as the Indian River section. Also it has been my privilege to have direct charge of one or two groves that are known to be typical hammock groves.

The fame of Indian River Brands of fruit has become fairly well known to the average grower in Florida, and to the principal markets. The general accepted theory is that fruit from this section possesses superior quality. Much fruit is produced in this section that attests this fact. I have seen oranges and grapefruit picked from some of those groves that was of the finest quality; so smooth of surface, it would correspond to that of kid glove and skin that was so thin it is difficult to peel without cutting away some of the meat; and with this a firmness to the whole fruit; and so packed with juice that it seemed the peeling must be stretched to its limit to contain it. The flavor of this fruit leaves nothing to be desired. I have seen fruit of this sort and have grown some but only on the truly hammock lands. Not all of the fruit that comes from the Indian River section deserves the reputation that this section enjoys. I have seen just as fine fruit in other sections of the state, but only on soils of a similar character to that of the hammock land of the Indian River section. For various reasons, various people take credit to themselves for the superior quality of fruit that has been grown under their supervision, or ownership, on groves of the Indian River hammocks, but it has been my observation that the success of the same people in producing fine quality of fruit, has varied directly with the character of the soils as their grove extended from the low hammocks to the high ridges. The ridges of the Indian River section are growing largely the same quality of fruit that is grown in any ridge grove area.

If this is true, then there must be something of vital importance that nature has placed in the hammock soils, that makes it possible for the production of superior fruit. In so far as I know, the greatest difference between this soil and others may be summed up in one word "humus." There is one factor that is of tremendous value. and that is the greater abundance of moisture in the hammock soils as compared to the ridge soils, and of course the tremendous amount of thoroughly decayed vegetable matter in the hammock soils enables them to retain the moisture better.

The reputation of the Indian River fruit has been made largely by the products of these groves that were started immediately after the big freeze of the winter of 1894-95. These early planters knew the value of hammock land. It meant that for years to come they could grow trees and produce fruit at a minimum of expense and these rich lands would give them a maximum of returns in fine quality fruit, for that which he could supply bountfully, which was hard work. These early grove owners knew nothing of the nine-hour day of labor, theirs was from daylight until dark.

Their equipment consisted of an ox, a hoe, a shovel, and with some a mule, and plow and harrow. The lands they selected were the heavy hammocks literally covered with a dense growth of holly,

hickory, live oak, dogwood, magnolia and cabbage palmetto. These soils were the product of centuries of accumulation of decaying vegetable matter. The usual procedure was to clear away a strip some ten feet wide on which the trees were to be set. This space was carefully cleared, and all roots removed to a depth of two feet. All forest trees in the remaining areas, were immediately girdled. As soon as the planting was finished, then began the work of clearing all of the remaining ground. The growth such as oak logs, palmetto logs, brush and what not was piled in long windrows between the trees, and there it lay until it had decayed. It took no scientific expert to guide those common sense old pioneers in the conservation of all the organic material that was produced on this land, even though it was already tremendously rich in this material. Naturally those plantings which entailed so much hard labor, and at a time when money for the employment of help was so scarce, were made in the most selected hammocks. Later years as the industry began to grow rapidly, large operators came in and made new plantings, and in their rush to get the land completely cleared, and with plenty of money for this initial expense; cleared large areas, cutting, piling and burning every bit of organic material that was found standing on the land. It was an economic loss. If I were clearing hammock land in this section today, I should follow the plan of those old timers; I would conserve every scrap of organic material. It is what made the hammocks different from other soils; and it is the reason why these soils have produced a quality of fruit that has made the Indian River section famous.

The root stock on these groves is almost entirely sour orange. These early grove men often got their root stock from the wild sour orange trees that they found growing on the very land they were clearing. Many an orange tree, in these groves, that has been giving its owner wonderful fruit for years and years, is on a native wild orange root stock, that may have been 40 years old when it was budded or grafted. In all plantings of budded trees in later years, the sour stock has been used almost entirely on all hammock lands, both on the high hammock as well as on the low hammock. And in fact up to the last ten years this type of root stock was used almost entirely throughout this section, on all types of soils. In recent years much lemon root has found its way into plantings of groves, but not on any of the hammock soils. In many of these early plantings the trees were not very accurately spaced, and, if they were, the distance apart seldom was over fifteen to twenty feet. As a result these groves are almost inaccessible with the modern tractor with its disc harrow, and other tools, that have perhaps done as much harm as they have done good. I do not mean to condemn these tools. They certainly have an established place in the Florida grove system, but they do such fine work, and do it so easily, that many of us who own this sort of equipment, over-do it.

These early growers were from necessity forced to do the greater part of their cultivation by hand labor, and with no more improved equipment than a one mule plow and harrow. From this we naturally find that they did as little cultivation as possible. Their biggest task, after the land was cleared, was to cut down the heavy vegetable growth from time to time, and hoe in their fertilizer, and often times they did not even hoe in their fertilizers. This practice of limited cultivation has been handed down and today even with more systematic planting and improved tools, the cultivation in all hammock groves is comparatively small. There is one thing that has always impressed me in this system of cultivation by hand as followed by these early growers, and which is practiced very extensively even today in those famous hammock groves north of Titusville, on Merritt Island, and along the ten mile section west of Ft. Pierce. It has automatically brought with it a system of making the individual tree the unit of attention. Not one tree escapes the attention of the owner as he leads or directs the hand work through these groves. It becomes his aim to make every tree do its best. Every tree comes before his inspection and if there is some special attention needed, the individual tree gets it. I believe if the growers of the state of Florida would adopt the individual tree as the unit of care, instead of the acre or the quarter section, it would quickly show a tremendous improvement in the quality of the fruit grown. When one considers the tremendous

amount of money spent for cultivation, fertilizing, and general care of groves in Florida, and the relatively small percentage of first class fruit that is actually produced, it is appalling. We are attempting to carry on in a tremendous wholesale way, an industry that finds its highest quality of production, only in perfection of the individual unit of production.

FERTILIZING

In the matter of fertilizing the hammock groves, the owner has in a general way, the same problems as those of the grove owner anywhere. It is largely a matter of judgment, and ability to correctly analyze the needs of the tree, and then make the application. In the very beginning the hammock grove gets some fertilizer. It may be a handfull, two or three times a year, according to the appearance of the tree. Usually the formula is very low in ammonia and high in potash. This is desirable for the best character of growth on the young tree. Care is taken to avoid forcing the tree too much. It is an easy matter to do this on those rich hammock lands. At the age of six years the trees are getting only about eight to ten pounds of fertilizer a year, while at the age of from twelve to twenty they get from twenty to thirty pounds per year. At this point the grove may begin to show distress from exhaustion of native richness of the soil; from this time on the hammock grove owner is facing problems of replenishing his organic material, similar to that confronting the grove owner of thinner land. The new grove will use, usually, a formula of fertilizer running lower in ammonia and higher in potash than is used on higher lands. I have known some hammock groves to receive not more than three per cent ammonia and not less than eight per cent potash at any time of the year, and often the summer application would be two per cent ammonia and ten to twelve per cent of potash. The phosphoric acid is kept rather constant at six to eight per cent. In the past, hammock grove owners have in some cases resorted to the use of all chemical fertilizers. It has been my observation that where this practice was followed over a period of years, in spite of the tremendous amount of humus that was in those soils, the trees began to harden. The leaves became smaller, and thinner; the growth is shorter and less vigorous, and the fruit begins to decrease in size. I recall one owner of a very fine hammock grove that had become so firmly convinced that any form of organic material in his fertilizer would give his trees 'die-back" that he used for years a chemical formula running 3-8-10 for the spring application and a chemical formula running 2-8-10 for the summer application. (Many grove owners practice the use of only two general applications per year). The last time I talked with this man he had decided to change his brand of fertilizer. "The fertilizer he had been using for years," he said, "used to get him good results, but lately it has been falling down" and all this time his fertilizer came from chemical materials, only supplying the three elements, ammonia, superphosphate and potash. It is true, as he argued, that his land had been producing good cover crops, but even these were getting lighter every year. If this man could only have set down in the woods, in an uncleared hammock, for half a day and pondered on how nature had made that hammock so rich, and then gone back to his grove and done what he could to imitate nature, he could have saved himself a lot of worry. What that hammock grove needed was more organic materials. What that grove needed was a few applications of fertilizer running from forty to sixty per cent of organic materials, to build up active bacteria in the soil. I have never yet seen or created any injury to groves on heavy hammock soils by the use of a reasonable amount of organic materials in the fertilizer, and particularly on these old hammock groves. The drain on these soils from years of crop production is tremendous. Those originally rich soils can not stand the strain indefinitely. It has been my observation that with all the humus that is returned to these soils annually from the naturally heavy vegetable growth, that the supply of organic material is steadily depleted by the removal of crops and development of trees over a period of years. It has been my observation that the bacterial activity is reduced even on these rich soils to such a state that the addition of some form of quickly available material in addition to the cover crops, that will stimulate bacterial activity, is necessary.

I know of no better way of doing this than by the use of a properly balanced fertilizer containing organic materials in accordance with the needs of the soil.

I look with a great deal of apprehension on a system of fertilizing which calls for the use of nothing but mineral fertilizers. I have searched diligently and have observed carefully, and I have yet to find substantial experimental data, or satisfactory results from the practice of such a system sufficient to warrant its recommendation for exclusive use.

The reverses that have come to growers during the past few years have been very disturbing, and the low returns of fruit this year have made growers everywhere particularly susceptible to new ideas, untried formulas, and half baked experiments, which are being offered. I do not want to convey the impression that I do not heartily approve of research in experimental work. On the contrary, research work that is carried on with proper degree of thoroughness and over a sufficient period of time, the results carefully and accurately checked and properly analyzed, and the conclusions placed in words that can be readily understood by the average grower, and put into practice—this sort of research work is of inestimable value. Never before in my fifteen years in this business in Florida has the state been so over-riden with so many "experts" who have evolved new plans of salvation for the citrus grower. All of these schemes and 'isms have one thing in common, they each and all of them are going to show the grower how to grow more fruit, better fruit, and at half the price, with this exception—the grower must pay the expert for his service or for his goods. There are times when I am dazed by the rapid turn of developments. I spent four years in college studying horticulture, and then for eighteen years I have tried to practice it, and studied constantly; and I have spent fifteen of those years in Florida, yet I meet every once in a while some expert who has been in the state anywhere from one to five years, who can tell me more about citrus culture than I ever hoped to learn. The amazing fact is that the one year man knows more than the five year man. To me all of this is a warning. It is a danger signal, that I must at this time above all times sit steady. Whatever I do with my grove must be done only after careful deliberation, and in line with only well established and time proven practices. It is my thought that during these times when the whole world is trying to get something new started, when there is a bewildering barrage of propaganda being spread for the purpose of disturbing everything, from our usual method of combing our hair, to a radical change in the fundamentals of our Republican Government;—under these conditions I reason, that little wonder the citrus grower is going to be told that all he has ever done may be wrong and he must right about face if he expects to survive.

In closing the subject of fertilizing the hammock groves, I want to say that the reputation of the Indian River fruit was made by fruit grown by the use of properly balanced fertilizers, containing the three essential elements of plant food, and derived from such a variety of sources as best offer the tree its nourishment at a constant and steady rate throughout the year. There is no class of grove property that will tolerate unbalanced methods less than the hammock grove. It is particularly sensitive to neglect and radical practices, but like a thoroughbred responds beautifully to a common sense method of handling. Mother nature in building the hammock lands, never contrived, though I think she could have done so if she had thought best, to let loose a wad of ammonia at one time of the year, and a shot of phosphoric acid at another time, and then at her convenience feed her plants some potash. To Mother nature this method must have appeared unsound. Let us ignore a lot of bewildering theorizing, and confine our activities to following the example of Mother nature, when she built the wonderfully productive hammock soils. The more we conform to her example, the more conveniently she can turn our best efforts to our best interests. Mother nature tries to feed her trees a complete plant food, containing all the elements essential, and to give them steady and constant nourishment.

CITRUS GROVE PRACTICES ON THE ROCKY LANDS OF DADE COUNTY

By C. H. Steffani, Homestead

When asked to prepare a paper before this Society on Grove Practices on the Rocky Soils of South Dade County, or what is known as the Redland District, I hesitated somewhat, due to the wide variation in opinion among the growers, and that no definite general practices either in grove culture or fertilization has ever been conclusively worked out.

The paper which I am about to present is taken from my notes and a survey made of twenty-five growers having good producing grapefruit and orange groves in the Redland District. The trees in these groves vary in age from eight to fifteen years, and covering 690 acres. Practically all of these groves were planted on land that had been scarified either before or after planting with a five-ton V-shaped plow with three-inch steel teeth, drawn by a forty-horsepower steam tractor. Some of these groves were surface dragged with a large iron tractor wheel, lying flat on the ground, and pulled with a 60-horsepower caterpillar tractor, breaking off the top surface of rock and smoothing the surface for future cultivation. The holes blasted with dynamite from two to four feet deep were made before planting the trees. A natural cover crop of natal grass and shepherd needles are the principle vegetation grown in these groves. Twenty-three of the twenty-five growers practice mowing this material, two or four times per year, applying the material mowed around the trees for mulch. The mowing is usually done after fertilization. The cost of mowing running from seventy-five cents to $3.00 per acre, with an average cost of $2.00 per acre, the variation in cost, due mostly to some growers using hand labor while others use mowing machines. Some of you may wonder in your minds that instead of growing that natural cover crop in our groves, why we do not make a general practice of growing crotalaria, beggarweed or some other nitrogen gathering cover-crop during the summer months in our old groves, where the roots extend to the center of the rows. It can readily be seen in order to plant these cover crops from year to year, it would be necessary to run a disc-harrow or a heavy drag over this rock to loosen it sufficiently to plant the seed. In this case it would be harmful to the feeding roots that are close to the surface.

PRUNING

Practically all growers practice pruning of the trees in their groves. In most cases this work is done during the summer months, from May until September, due perhaps to the fact that most growers have more time during the summer months to do the work. About twenty per cent practice pruning during December and January.

SPRAYING

It is interesting to note in this survey that the number of growers who spray for Citrus Scab and for Rust Mites are about evenly divided with those who do not spray. Getting down to actual figures sixty per cent spray for Scab and Rust Mites, and the other forty per cent of these growers do not spray. The time of spraying for Citrus Scab by these growers runs from November to February. The largest percentage spraying in January. In spraying for Rust Mites most of the growers sprayed in April, and a small number sprayed again in November on oranges. The cost of applying both of these materials ran about the same, from $4.00 to $6.00 per acre, each spraying.

FERTILIZATION

From observations made covering the growers experiences for the past two years with ready-mixed fertilizer formulas, a great variation was

found to be used by these growers. To be exact ten different ready-mixed fertilizer formulas were used, with little difference in ammonia, and a wide variation in the amount of potash. The phosphoric acid in all formulas used was eight per cent. The variation in ammonia was two per cent, the formula lowest in ammonia carried three per cent, and the highest five per cent, running about sixty per cent chemical and forty per cent organic. In some few cases there was fifty per cent chemical and fifty per cent organic. The variation in potash was five per cent. The formula lowest in potash carried three per cent, the highest carried was eight per cent. Seventy-five per cent of these growers use sulphate of ammonia or nitrate of soda or sulphate of ammonia and nitrate of soda mixed on a fifty-fifty basis for the very early spring application applied in late December or early January, the largest number applying it early in January. Following this application of ammonia, the regular spring application of fertilizer is applied in late January or early February, from four to six weeks after the early spring application of ammonia is applied. The majority of these growers used a 4-8-5 fertilizer formula, the next largest group of the twenty-five growers used a 5-8-5 formula. The summer application of fertilizer was applied in April and May by the majority of growers. The largest number being about equally divided between the fertilizer formulas 4-8-5 and 4-8-8. The fall application of fertilizer applied by the majority of these growers to their groves in October and November was the same formulas, 4-8-5 and 4-8-8, as applied in April and May.

In selecting these twenty-five growers from a group it might be advisable to call to your attention that they were selected due to the fact that they all have been successful in their grove operation, and have good producing groves, in good condition regardless of the variation in fertilization and yet the majority are so near to one another in their fertilization and general grove practices. It appears from this information until some more definite plan of work is carried out by our Experiment Station in grove culture and fertilization on this type of soil, that it will be well for us to follow the general practices of grove culture and fertilization practiced by the majority of these successful growers as outlined above.

COMPARISON OF CROTALARIA STRIATA TO CROTALARIA SPECTABILIS AS TO THE ABUNDANCE OF PLANT BUGS

By J. R. Watson, Agricultural Experiment Station, Gainesville

The use of the Crotalarias as cover crops in citrus groves is rapidly increasing. The large tonnage of organic matter which they produce to be turned back into the soil is very attractive to citrus growers, and the thorough shading of the soil makes conditions more favorable in the grove for the growth of the entomogenous fungi which help to keep down whitefly, scale insects, rust-mites, and mealy bugs. The one insect "in the ointment" has been the Southern Green Stink Bug, often called Pumpkin Bug by our growers. I do not need to describe them or their work to the members of the Florida State Horticultural Society, but a few words as to their seasonal history will enable us better to intelligently combat them. They pass the winter partly as hibernating insects under boards and bark, etc., and partly as active feeders on the more succulent truck crops, such as lettuce, petsai, collards, turnips, rape, potatoes, radishes, etc. At Gainesville about half of them hibernate under boards, etc. The other half will be found in truck gardens, dormant during the colder days of the winter but actively feeding during the warmer days. Among wild host plants,

the thistles are favorites, especially when they begin to send up their flowering stalks. At Gainesville, however, very few eggs are laid until April, and the spring broods are usually not large. But as cowpeas and velvet beans begin to develop some size, the number of pumpkin bugs increases rapidly, and with the coming of late July and August, beggarweed is a favorite host. Very few are found on Crotalaria until young pods begin to appear; in other words, until the Crotalaria begins to bloom. As long as the Crotalaria carries plenty of green pods, it serves as an excellent trap crop to keep them off of citrus. Its attacks on citrus have always followed the disappearance of green pods from the Crotalaria. A drought, early frost, or heavy winds accompanying hurricanes, are some of the agents which have stripped the Crotalaria of green pods and caused the pumpkin bugs to migrate to citrus. But the most common cause of trouble has been that the Pumpkin bugs themselves became so abundant as to strip all the green pods from the Crotalaria, obliging the bugs to move to citrus. The Crotalarias do not breed pumpkin bugs any more than other common cover crops. Not as much as does either beggarweed or cowpeas, but there is this difference, the Crotalarias produce their pods late in the season up to the time when citrus fruit begins to be mature enough to attract the bugs. Cowpeas and beggarweed ordinarily begin to die down before the fruit is attractive.

We see from the above seasonal history of this insect that the thing to avoid is a continuity of host plants. Whatever cover crop is raised in the grove should not be mixed with others so as to give the pumpkin bugs a continual succession of favorable food plants throughout the summer. *Crotalaria striata* does this to some extent. It will begin to bloom and produce pods in small numbers sometimes as early as June, and continues to produce pods all summer, and up to the time when the citrus fruit is attractive. The presence of *Crotalaria striata* in a grove, of course, does not always mean an abundance of pumpkin bugs. Parasites often, even usually, control pumpkin bugs in a grove. Of these, the feather-legged fly and the *Trichogama minutum*, a wasp-like parasite which attacks the eggs, are the most important.

The quite extensive planting of *Crotalaria spectabilis* during the past season gave us an opportunity to make direct comparisons between this species and *striata* as to the abundance of plant bugs. Because of the difference in the blooming habits of the *spectabilis*, we expected that this plant would be much less attractive to pumpkin bugs. Instead of beginning to bloom early in the summer producing a succession of pods to breed pumpkin bugs, as does *striata*, it produces no bloom at all in the early part of the summer, but in the later part of the summer, say about September, produces an extensive bloom and a very heavy crop of pods, usually dying down to a considerable extent after maturing this heavy crop of seed. The fruiting season of *Crotalaria spectabilis* is very brief; too brief to enable stink bugs to multiply in large numbers.

Observations during the past season have verified our ideas far beyond our expectations. All groves in which a pure stand of *Crotalaria spectabilis* was grown have been practically free of pumpkin bugs as far as our observations have gone, and these observations have covered many groves from Marianna to Lake Wales. In September, in a large Satsuma plantation near Marianna, two of us looking for several hours found only half a dozen plant bugs, and these were on some volunteer cowpeas in the grove. A grove near Lake Wales was particularly interesting. Part of this grove was planted to a mixture of *Crotalaria striata* and *Crotalaria spectabilis*, and another part to a pure stand of *Crotalaria spectabilis*. In the latter there were practically no pumpkin bugs whatever, but where the two were mixed pumpkin bugs were found on the pods of both species when the pods of *spectabilis* were in the right stage for infestation, i. e., green and succulent. This observation has been repeated in other sections; i. e., the pumpkin bugs seem to be just as fond of the pods of *spectabilis* as they are of *striata* but the *spectabilis* pods are present in an attractive stage for such a brief period that pumpkin bugs do not have time to develop in large numbers. Observations wherever made in the state have shown that where *spectabilis* is grown in a grove those groves are almost immune from plant bug injury; more nearly immune than in the case of any of the common

cover crops that we raise, including cowpeas, beggarweed, or even the wild grasses and other plants which volunteer in our groves, as these latter nearly always contain native legumes which are host plants for pumpkin bugs.

We apparently have in the *Crotalaria spectabilis* a cover crop which is perfectly safe from the plant bug standpoint if in a reasonably pure stand, but if it is mixed with large numbers of other plants which will breed pumpkin bugs during the early part of the summer, this immunity may be largely lost. Do not mix *Crotalaria spectabilis* with *Crotalaria striata*, beggarweed or cowpeas, if you want to secure this immunity from pumpkin bugs.

I must not leave the subject, however, without warning the growers that during the past season, at least, *Croalaria spectabilis* has not done as well on the drier, lighter soils as has *Crotalaria striata*. Perhaps last summer was not a fair test, as the rainfall during July and August was markedly deficient over much of the state. At Gainesville, for instance, it was only half normal. In other words, we felt a little influence of the great drought of the more northern states, but fortunately it came at the time of the year when we usually have twice the amount of rainfall we need, so it was scarcely noticed. On the whole, however, we can safely say that *Crotalaria spectabilis* will not stand drought as well as *striata*, and should be planted with caution in the drier, sandy citrus groves. On the other hand, it will grow in more moist situations than will *striata*, and should be an ideal cover crop for truck lands during the summer time as well as for citrus groves, on soil which retains water reasonably well.

The Crotolarias make a particularly happy combination for the feather-legged fly. These flies feed on the nectar of blossoms and are particularly fond of crotolaria.

Thus for the flies, the crotolaria supplies both food and a host for the deposition of eggs, both right there handy. In other words, crotolaria is both a cafeteria and a nursery for those flies.

Mr. Rowe of Redlands: I would like to ask what differential there is in the amount of nitrogen brought to the grove by the two different varieties?

Prof. Watson: I believe extremely little. There is a little difference in favor of striata, if my memory serves me correctly, but it is very small.

CRYPTOLAEMUS LADYBEETLES AS A CONTROL FOR MEALYBUGS

W. L. Thompson, Citrus Experiment Station, Lake Alfred

It has often been said that if the human race is to prosper and live, a continual war against insects must be waged. Fortunately nature has come to our aid in the matter, as she has done in many others, by supplying insects that prey upon others.

During the past year the Department of Entomology of the Agricultural Experiment Station secured from the California Experiment Station a colony of ladybeetles known as the "Mealybug Destroyer" or scientifically called Cryptolaemus montrousieri (Muls.).

According to Essig's, Insects of Western North America, "this species of ladybeetle was introduced from Australia into California in 1892 by Albert Koebele and has proven to be one of the most proficient enemies of many kinds of mealybugs in California where it is firmly established."

Although this species of ladybeetle has become established in California, millions are propagated each year to be liberated in groves infested with mealybugs. Mass production of the Cryptolaemus ladybeetles in California was started in 1916. The successful demonstrations of the value of

artificially propagating and distributing these beetles has led to the establishing of fourteen insectaries in Southern California.

To control almost any insect pest by means of predators or parasites, one should have these agents in the field when the infestation is in its infancy. Once an infestation is well under way, the introduction of parasites and predators is of little value in controlling the pest during that season. The Vedalia ladybeetle (Rodolia cardinales Mulsant), predator of the Cottony Cushion Scale, is an exception. It must be understood that when a parasite has destroyed its host it often dies of starvation which is the reason for reintroduction of some parasites each year, or when the occasion arises.

The Cryptolaemus adults are about 3.5 mm. long; the color is black with the head, pro-thorax, and tips of the wings a reddish color. The eggs are very small, oval in shape, and laid singly among the mealybugs. The larvae are yellow and covered with white waxy filaments. One not acquainted with the appearance of the larvae might easily mistake them for mealybugs, especially when they are small.

Since these beetles have been received at the Citrus Experiment Station at Lake Alfred, a number have been reared and some liberated with the idea of establishing them in Florida and to become acquainted with the methods of rearing them in insectaries, or such places that can be made available.

In rearing these ladybeetles the common citrus mealybug, *Pseudococcus citri* (Resso), was used as the host, and potato sprouts were used as the host for the mealy bugs. The method of propagating these predators was copied, to a great extent, from a system used in California. Valuable information was obtained from a manuscript, "The Mealybugs Attacking Citrus and Their Control by the Biological Method" by Harry S. Smith and H. M. Armitage of the California Experiment Station.

As stated above, the mealybugs were reared on potato sprouts. The potatoes were planted in trays or flats fourteen and one-half inches by sixteen inches by four inches, three fourth-inch material was used. The flats were constructed so that the sides extended out three-fourth of an inch from the bottom boards, making it possible to use the sides of the flats to slide them in and out of the racks. The soil used for planting the potatoes was obtained from a cow lot. The flats were filled about two thirds full of soil. When the potatoes were planted, they were pushed down firmly into the soil, watered, and then covered with about one-half inch of sand. It was not necessary to wet the soil again. In some of the first plantings the sprouts were watered after they came up, but later a form of damping off occurred. If whole potatoes are used, there appears to be enough misture and food to carry the sprouts through the period of usefulness.

The "Red Bliss" potatoes were found to be best suited for this work. It is rather necessary to use a known variety which are well matured to insure prompt sprouting. Some potatoes of an unknown variety purchased at the market were very slow in starting to grow and when the sprouts did appear ,they were of a purplish color and made very little growth. Mealybugs thrive much better on white sprouts. When well matured potatoes were used, the sprouts were up high enough in two weeks to inoculate them with mealybugs. It took as long as four weeks for less mature potatoes to start growing.

It is quite essential to infest the potato sprouts with mealybugs free from disease such as the fungus disease that attacks them in Florida. After a start of mealybugs has been made in the insectary, it is not necessary to bring new material in from the field. When flats of new sprouts were to be infested, the writer either transferred egg masses or took heavily infested sprouts and peeled them, laying the thin strips over the fresh sprouts. In twelve hours the mealybugs had crawled to the fresh material. In California temporary hosts are used; such as wild sunflower, Australian pepper, and wild tobacco. Stems of these plants are placed in an infested flat, and when the mealybugs have crawled on them they are transferred to the new sprouts. The temporary host soon wilts and the young mealybugs move to the potato sprouts.

The flats were placed on racks which were so constructed that a space of one foot was left between each tier, leaving room for the sprouts and ventilation. The flats were in tiers of four high

and could be slid in and out of the rack. The racks were built on legs so that they could be placed in pans of water to keep out invasions of ants.

The work at the Citrus Experiment Station was carried on in one of the basement rooms of the laboratory for lack of more space. It was heated by steam pipes which run through to other parts of the building. The temperature ranged from sixty to eighty-five degrees but eighty degrees appared to be about the right amount of heat for the rapid growth of ladybeetles and mealybugs. It was noticed that the sprouts in the upper flats where the temperature was higher were always heavier infested with mealybugs than the lower ones. The top flats in the breeding cage also had more ladybeetle larvae than the lower ones. When the room temperature was as high as eighty degrees the adult beetles loose in the room, would gather near the heat pipes. When the approach of warm weather, no fire was needed to heat the building and the temperature during the day was about sixty-five degrees. At this temperature the mealybugs and beetles grew very slowly. At the present time a room in the insecticide building is being used. With the natural increase in temperature the insects are growing faster, but this room is not so satisfactory as the one in the laboratory was during the winter when there was heat day and night. In the present location the room is cool each night and during cloudy days. The room is kept almost dark to prevent the sprouts from turning green.

Three rooms would make a much more desirable arrangement for this work; one room in which to grow the potato sprouts and rear the mealybugs; the second for the adult beetles; and the third in which to rear the ladybeetle larvae. The first two rooms need no windows although ventilation should be provided. The third should have a window at one end to attract the young beetles when they emerge so they can be easily collected. When all three operations are carried on at the same time in one room, the adult beetles that escape from the cage are quite likely to find their way to sprouts that are just being infested with mealybugs and deposite eggs causing the young larvae to clean up the mealybugs before they mature.

As only one room was available for this work, a cage was built large enough to hold eight flats. The cage was covered with a twenty-two mesh copper wire screen and was used to handle the adult beetles. Twenty beetles were placed in each of the eight flats of infested potato sprouts. The flats were allowed to remain in the so-called breeding cage for twenty days. At the end of that time they were removed and placed in the racks until the larvae had matured. Fresh material was put into the cage for the adults.

As the ladybeetle larvae are of a predacious nature, they should be as near the same age as possible in the individual flats. When beetles are in the pupa stage, they are defenseless; and young larvae are quite likely to devour them, especially if food is scarce. If the flats are allowed to remain in the breeding cage over a long period, the adult beetles continue depositing eggs, resulting in an over population of all ages of larvae. Before the larvae mature, they will have cleaned up the mealybugs, and then turn on each other or attack the pupae.

After the flats containing the larvae were removed from the breading cage and placed in the racks, strips of burlap were hung in front and back of the racks to which many of the maturing larvae crawled and attached themselves for pupation. Many of the larvae were attached to the sides of the flats and on the racks.

When the adults emerged, they gathered on a window that was screened with white cloth and were collected in a common test tube.

A duplicate of the breeding cage was built to house the young beetles. These beetles were later mixed with the older ones.

The average larvae matured in about twenty-two days and was in the pupa stage twelve to fourteen days.

Fifty-seven days elapsed from the date the first lot of 150 beetles were introduced on the infested potato sprouts until the majority of young beetles had emerged. There were approximately 2,000 adult beetles in the first generation.

According to H. S. Smith and H. M. Armigate the period of full oviposition of the beetles is six weeks; the majority of eggs are deposited during the third and fourth weeks. The larvae feeding period is twelve to twenty days and the pupation

period eight to twelve days. One flat may produce from 400 to 1,000 beetles but 400 are about the average.

The method of distributing the beetles in California is as follows: Small standard medicinal gelatine capsules were used, size '000' three-eighth-inch diameter and one-inch long. Ten beetles are placed in each capsule, as that number has been found sufficient for each tree. The beetles have lived in these capsules from five to seven days; but unless necessary, seventy-two hours should be the limit. The man distributing the beetles in the grove has the full capsules in one pocket. He then goes to each tree and throws the beetles into the center of the tree and places the empty capsules in the opposite pocket. It has been found that a more even distribution of beetles can be obtained in this way than by liberating them between the rows of trees.

The approximate date when the beetles should be liberated in Florida has not been worked out, but it should be just as soon as there are enough mealybugs to support them. The beetles should be at least two weeks old before being liberated so that the females will be more likely to deposite fertile eggs as soon as they find a colony of mealybugs.

The reason for securing these beetles was not to combat the mealybugs on citrus alone, but for any other crop that is infested by this pest. When various bulbs are in storage, they are often attacked by mealybugs. By screening the bulb storage house and introducing the Cryptolaemus ladybeetles, a control of mealybugs should be obtained.

A small quality of bulbs infested with mealybugs were placed in the room where adult beetles were loose. The beetles found the infested bulbs, young larvae soon appeared, and the mealybugs disappeared. Some of the matured larvae attached themselves to the bulbs for the pupation period. From all indications these beetles should be a big factor in solving the mealybug problem of the bulb growers.

The Cryptolaemus ladybeetle is best known as a predator of mealybugs, but it does not appear to restrict its diet to them alone. In the laboratory the larvae have been observed eating Citrus aphis (Aphis spiraecola Patch), melon aphis (Aphis gossypii Glover), the elder aphis sp. and the false cochineal insect of pickley pear cactus and Cottony cushion scale eggs and crawlers. Young larvae placed on aphis infested orange trees reached maturity in twenty days. Adult beetles lived on citrus aphis in the laboratory twenty-seven days, eating from four to forty-two aphis per day; the larvae eating from zero to forty per day. The average was sixteen. Several hundred larvae of all ages were fed nothing but citrus aphis for a month, or until all the larvae had matured.

As previously stated in this paper, it is the desire of the Experiment Station to establish these beetles in the state. The rearing of large numbers of beetles artifically will have to be done by individual growers, or groups of growers, as the Department does not have the funds or facilities to carry this work on in a large scale. Since the mealybugs attack a number of different plants in the state and the beetles have a rather wide range of diet, it is quite possible that they can become established and therefore be of economic importance to our horticultural industry.

Question: Is this ladybeetle identical with what we call the Australian Ladybeetle?

W. L. Thompson: No sir, it is not. I presume you mean the one attacking the cottony cushion scale? No, it is not.

SOME NEW BASES FOR WEATHER FORECASTING

By M. R. Ensign and B. F. Dostal, University of Florida, Gainesville, Fla.

The peculiar weather changes which we experience from day to day and from year to year have generally been considered fortuitous in nature, i. e., a mere matter of chance. This view has not only been held by laymen but by the majority of scientists as well. Beginning with the work of Bigelow about 1900 and followed more recently by that of Huntington, Abbot, Clayton, Arctowski, Kullmer and others, evidence has been produced that seems to show that weather changes may be governed in part, at least, by cosmical or celestial forces. The sun and its variability as measured by direct radiation measurements and indirectly by sun-spots and kindred solar disturbances has been looked upon as the most likely causal agency, although Huntington has pointed out that the planets may play a part. In the monsoon area of India, for instance, barometric pressure has been shown to fluctuate in response to sun-spot frequency and Huntington showed that barometric gradient in the North Atlantic seemed to be greatest a few days following the appearance of spots on the limb of the sun. Bigelow, following the lead of Ellis, showed that barometric variations as well as changes in the magentic needle declination were closely correlated with sun-spottedness. Furthermore, storminess at various latitudes and longitudes, temperature, etc., were correlated with solar activity. Kullmer established the fact that at times of sun-spot maxima, there is a general shifting of storm tracks northward and at sun-spot minima southward. His data extends from 1883 to 1914. Abbot and Clayton have made some progress in showing a relationship between weather changes and solar radiation variations.

So much for a too-hasty review of some of the work bearing upon long-range weather forecasting based upon scientific evidence of extra-terrestrial forces.

Let us now turn to the solar system as now known. Suppose we sail out into intercellar space in a rocket car and take a bird'seye view of the solar system. (Fig. 1). And in Fig. 2 the Mercator projection of the planets, sun and moon relative to the earth's equator is shown (Fig. 2).

Two years ago we calculated the resultant planetary tidal (gravitational) force exerted upon the sun at monthly intervals from 1857 to 1931 inclusive. The nature of this force and its relationship to the sun spot curve is shown in Fig. 3, covering the period 1909 to 1919.

Besides this, we invite attention to the pulsation of tidal intensity showing maxima and corresponding minima on the average about fifteen months. These high maxima are split up into sub-maxima of length six to nine months. In passing, it is worthy of note that times of high maxima of planetary tidal intensity correspond to times of poor radio reception as predicted by Stetson from an entirely different set of data. And in view of Turner's work on the periodicity of earthquakes with maxima frequency about every fifteen months, we attach some significance to our tidal intensity pulsations—a point which we expect to investigate further.

Now, if we draw a line joining the high points of the tidal curve (from 1857 to 1931) we get the curve shown in Fig. 4 (solid line) and superimposed on this we see the Wolf sun-spot number's curve. The relationship is evident.

In Fig. 5 we show what appears to be a cause and effect relation between planetary tidal forces and terrestrial meteorology—both curves were obtained by using a twelve-year mean of (1) the absolute minimum annual tidal intensity and (2) the absolute annual minimum temperature for Jacksonville, Florida.

A similar relationship is revealed in the fit of the two curves shown in Fig. 6. About ten years ago Brooks published in the Monthly Weather Review the curve shown by the heavy line (inverted here) from 1872 to 1884 showing the peculiar and unexplained alternation of mild and severe winters as measured by the mean monthly temperatures of December, January and February for six

The Monthly Evening Sky Map

Orbits and Heliocentric Movements of the Planets March, 1931

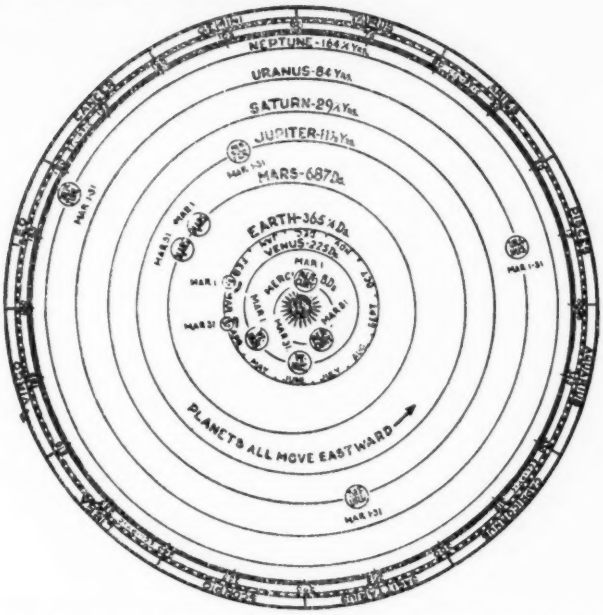


Fig. 1.—Showing heliocentric position of the various planets for March, 1931. Due to the inclination of the earth's axis, the major planets and Mars, when passing from 0° to 180° heliocentric longitude are, roughly speaking, north of the earth's equator and from 180° to 360° are south of it.

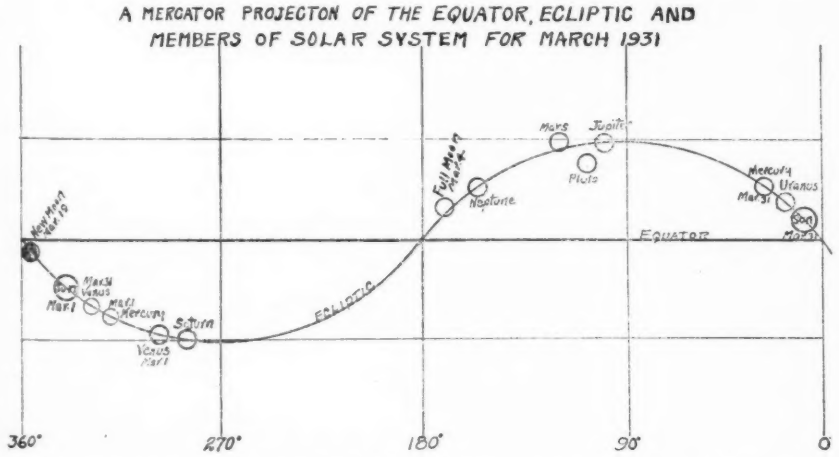


Fig. 2.—A Mercator projection of the solar system for March, 1931. The relative position of the planets, moon and sun with respect to a North (above) and South (below) position to the equator. Note the sun has just crossed from a South to a North position.

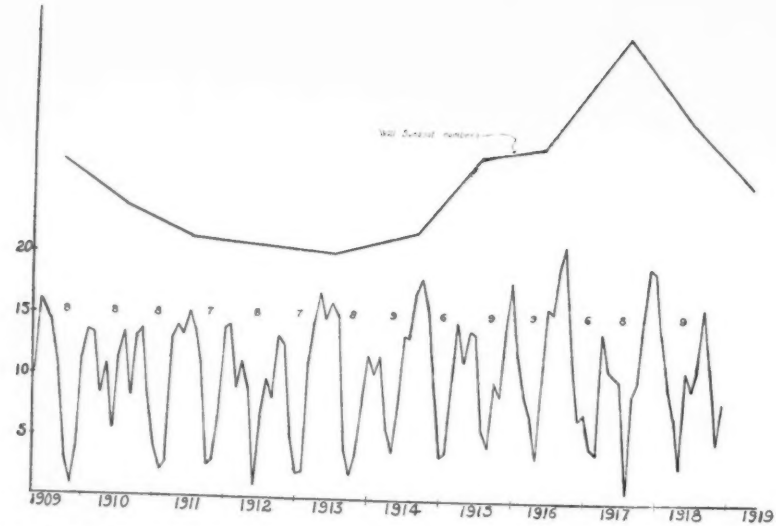


Fig. 3.—Showing the calculated resultant planetary tidal intensity curve (below) and the sun-spot curve (above) from 1901 to 1919. Note the pulsations averaging about 15 months in length from one maximum to the succeeding one.

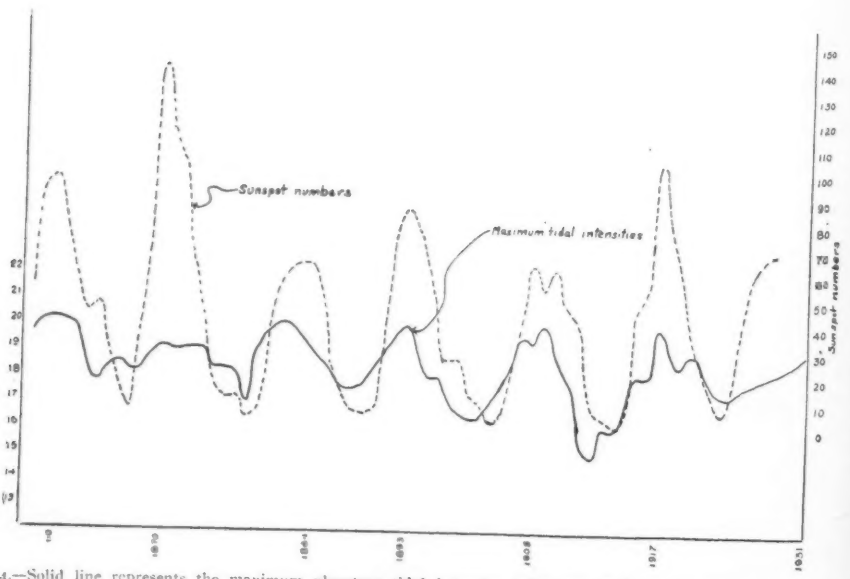


Fig. 4.—Solid line represents the maximum planetary tidal intensity, while the dash line represents sun-spot numbers. The tidal curve has been shifted to the right—corresponding to 11 months. This makes the high maxima of 1870, 1892 and 1917, exactly coincide with the sun-spot maxima.

principal Northeastern cities of the United States. When we take the mean planetary tidal intensity for the same months we secure the curve dash line (Fig No. 7), as shown. We have extended both these curves to 1899 with the result shown. For a period of fourteen years there is a 100 per cent agreement. From 1884 to 1892 there is evident in both curves a transition period followed again by a period of wide deviations from the normal in alternate years. Here it is interesting to note that for the most part the two curves are out of phase.

In casting about for a possible explanation of some of these peculiarities, especially the transition period, we note that during this time there is a shifting of the three major planets—Uranus, Jupiter and Saturn—from a point to the north of our equator to a point south of it (Fig. 7) and when this transition is complete there, again, appears the alternation of mild and cold winters. That this is merely a chance relationship, if unsupported by other data, is probably one in thousands.

The evidence so far presented points toward a relationship (1) between solar activity and terrestrial phenomena; (2) between planetary tidal intensity and solar activity and (3) between planetary tidal intensity and meteorological changes. In addition to these relationships, there is a strong suggestion that the position of the planets relative to our earth's equator may play a direct and important role on weather changes. We shall now pursue this idea further. Kullmer, as we have noted above, showed that from 1883 to 1914 the shift of storminess was northward during times of sun-spot maxima and southward during minima. We have studied the latitudinal distribution of storms (cyclonic) using Kullmer's method for the months of September, December and February of each year from 1900 to 1929. This embraces three sun-spot maxima and an equal number of minima.

We show first a composite picture of storm frequency for these three months between 50° and 52½° N. covering a period of twenty-nine years (Fig. 8). The trend from few to many storms between these parallels as we pass from the time of minimum sun-spots to maximum and vice versa for all three months seems to indicate clearly that *some underlying causal agents* are operative throughout the various months of each year. The minor variations may be readily explained. Special notice is invited to the decided increase of storminess at the time of the 1917 sun-spot maximum as compared to those maxima of 1906 and 1928. Further comments will be made on this point further on.

Now, if we study the latitudinal distribution of storm frequency for each of these months in turn near times of sun-spot maxima and minima respectively, further evidence of some extra-terrestrial recurring force becomes apparent. (Figs. 9 and 10).

It is clear that near times of sun-spot maxima (it may or may not coincide with the precise month or year) there is decreased storminess at lower latitudes, while the reverse is in general true at times near sun-spot minima. The tendency at the minima periods is for a much more even latitudinal distribution of storm frequency, and to show that it is a real latitudinal shift. Note Fig. 9.

There is one point which corroborates Kullmer's findings rather strikingly and that is a tendency, at certain times more evident than others, for a double peak in the curve—a major one at a north latitude and a minor one somewhere about 30° to 35° N., and between these a decided depression. We pause only to suggest that this may explain the droughtiness of certain areas corresponding to the position of this area of lean storminess. See Fig. 10.

In order to show that there is a progressive and not a sudden shifting of the storm tracks latitudinally as sun-spots diminish or increase in number, we offer the next two graphs. (Figures 11, and 12).

In the next graph (No. 13) we have a very striking relationship of storm frequency at Lat. 45°-47½° N. to that of the position of the major planets north or south of our equator for the Februaries from 1900 to 1929. The top row of asterisks shows times of sun-spot maxima and those at the bottom the minima. The relative position of the planets is shown by the letters (North at top and South at bottom). The large trend shown by solid curved lines corresponds to Saturn's period. Note that three of the majors

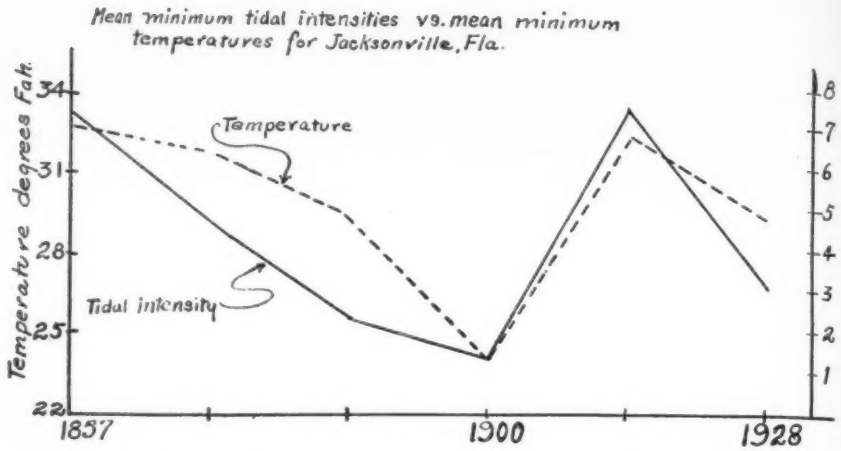


Fig. 5.—The smoothed mean annual minimum tidal intensity curve (dash) as compared to the smoothed mean annual minimum temperature for Jacksonville, Florida, from 1857 to 1931.

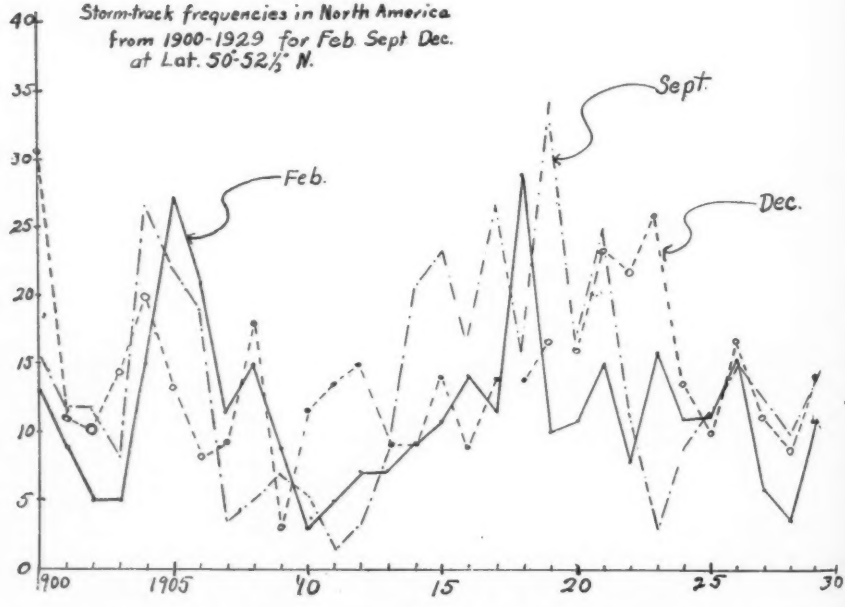


Fig. 7.—Showing the gradual shifting of Uranus, Jupiter and Saturn from a northern to a southern position from 1884 to 1894, corresponding to the transition period shown in Fig. 6.

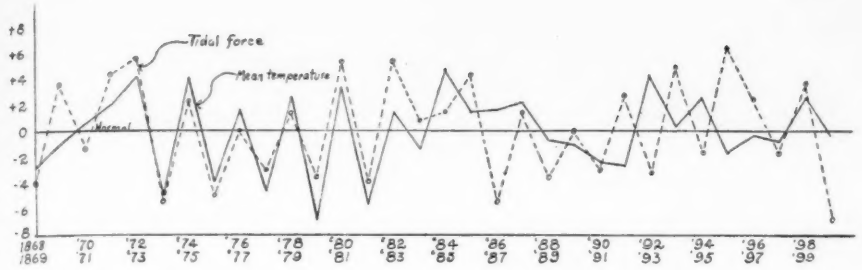


Fig. 6.—Relationship between mean winter (December, January and February) temperature for six northeastern cities and the mean planetary tidal intensities f r the same months from 1868 to 1899.

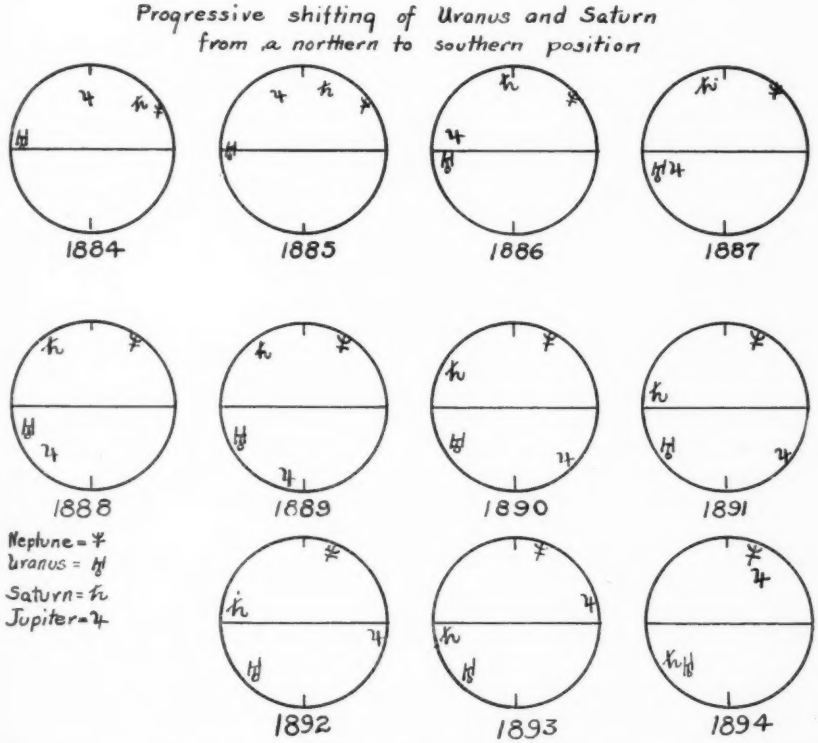


Fig. 8.—The storm frequency between parallels 50° to 52½° N. latitude from 1900 to 1929 for the months of February, September and December of each year respectively. The same general trends are clearly evident. The increase of storminess near times of sun-spot maxima, 1906 and 1917, is evident. The lack of storminess at the 28th maximum may be due to the fact that Saturn alone was in the south and Neptune in the north. Jupiter and Uranus were in the transition position, i. e., just crossing the equator toward the north.

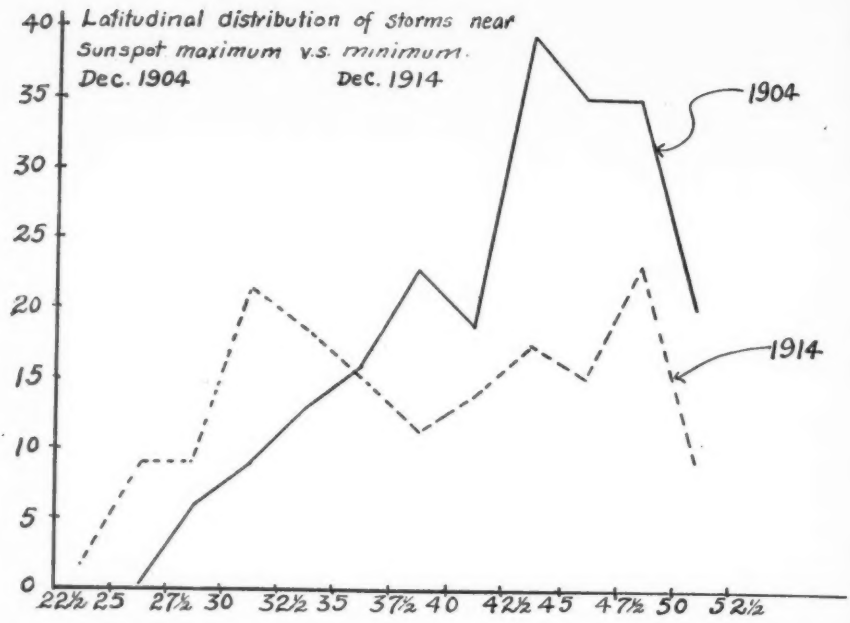


Fig. 9.—Latitudinal distribution of storminess for December, 1904, (near sun-spot maximum) and December, 1914 (near sun-spot minimum). The decrease of storminess at the northern latitude and the increase at the lower latitudes in 1914 is evident.

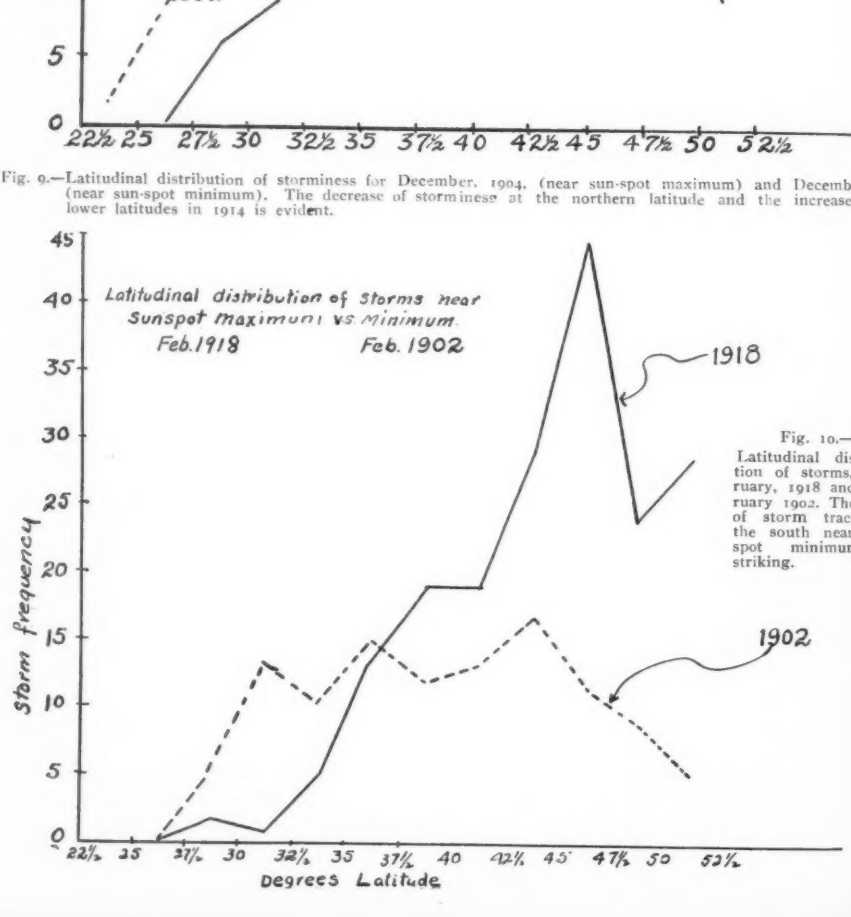


Fig. 10.—Latitudinal distribution of storms, February, 1918 and February 1902. The shift of storm tracks to the south near sun-spot minimum is striking.

were in the south at two sun-spot minima corresponding to least storminess at this northern latitude, and three in the north at one and the highest sun-spot maxima 1917 (see graph No. 8). A point to which we attach considerable significance is the lack of any appreciable northward shift of storm tracks at the sun-spot maximum of 1928. At this time Saturn was the only major to the south of our equator and Neptune the only major planet north. Both Uranus and Jupiter were at the Transition point of crossing the equator from south to north. This should be contrasted with the years 1917 and 1918, the time of greatest storminess at this northern latitude. Jupiter's period of about 12 years is clearly shown and is probably chiefly responsible for the north and south shifting of storminess, since he is usually in the north at times of sun-spot maxima and in the south at minima. The relative position of the other major planets appears to augment or detract from the storm frequency at various latitudes from year to year. Since the earth is constantly changing its relative position to all of the celestial bodies, the monthly variations in storm frequency may readily be found in this factor, especially the effects produced by the rapid moving minor planets. The well known annual shifting of storm centers southward in winter and northward in summer, as well as the formation of an ellipse each year in the North Pacific ocean by the center of high barometric pressure area comparable to our orbital motion around the sun, seems to lend considerable support to the idea that the position of celestial bodies with respect to the earth's equator is an important one.

Turning now to a more specific consideration of Florida weather and how planetary position may affect her, let us examine Fig. No. 14 which shows graphically the trend of storm frequency for the month of February since 1900 for the area 30°-32½° N. as related to rainfall in Florida. The agreement of the two curves is striking and they also show a rather clear tendency to follow the sun-spot cycle. The apparent discrepancies such as indicated in 1929 are readily explained by the fact that the larger number of storms shown for lat. 30°-32½° were much to the west, and merely emphasizes the need for a study of the longitudinal distribution of storms.

In Fig. No. 15 is shown again the deviation of storm frequency from the normal for lat. 30°-32½° N. for February as well as a curve of mean temperature deviation. The inverse relationship here is strikingly shown. During those Februaries of few storms the mean monthly temperature is above normal and *vice versa*. Since 1900 there is an unmistakable trend toward fewer storms and warmer weather. Exceptions are of course noted as the major planets, especially Jupiter, are north or south of our equator.

Fortunately, a record of the absolute minimum temperature for Jacksonville, Florida, is available since 1835. These are produced graphically in Fig. 16 (solid jagged line). Superimposed upon this is a line showing the trend of the minimum temperatures downward since 1836 to 1900 and thence upward. This represents roughly the period of Uranus, passing from north to south about 1885, and being farthest south about 1906. The dotted line is Saturn's period. The relationships shown in this case are strikingly evident, while a periodic analysis of these data shows clearly a period corresponding to that of Jupiter. Furthermore, there is a consistent recurrence of low temperatures each of the three times that Saturn has been passing through the 95 to 125 degrees of heliocentric longitude.

If we plot the storm tracks as given by the U. S. Weather Bureau in the Monthly Weather Review according to the time when the position of the moon is north or south of the equator, we secure maps like these (Figs. 17 and 18). In general, it is seen that in the cases shown there is rather a noticeable contrast in the direction of the storm tracks, especially in longitudes from 85° west. All of the maps examined do not show this so clearly, but here is a challenge for further investigation which we are following. From other observational data regarding the occurrence of storms, i. e., cyclonic low pressure areas and the resulting anticyclonic formations furnish further evidence of a direct lunar effect of considerable moment.

With the information presented above as the bases, it seemed desirable to attempt a detailed weather forecast, since the proof of the pudding is in the eating. A very generalized statement of November, 1930, weather happenings was first

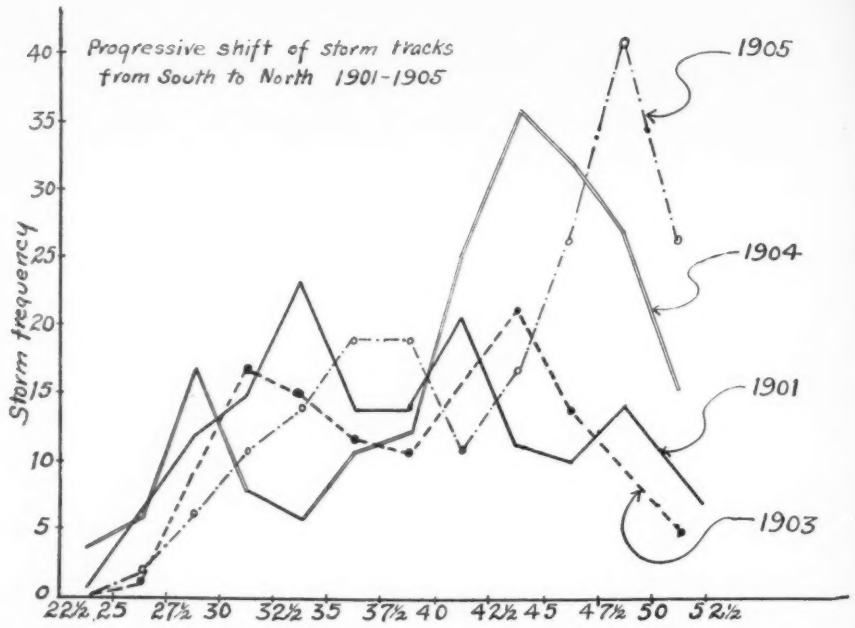


Fig. 11.—Showing the progressive shifting of storm frequency southward from 1905 (near sun-spot maximum) to 1911 (near sun-spot minimum).

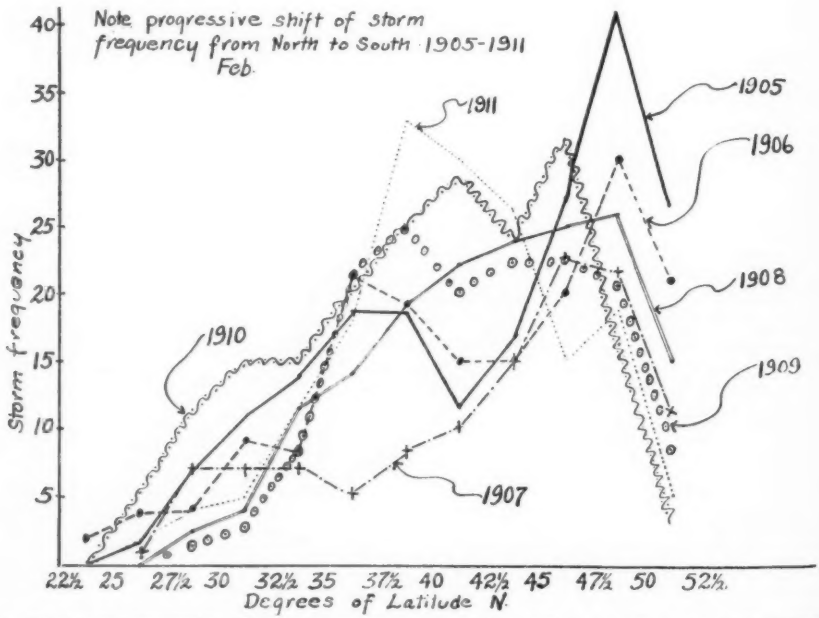


Fig. 12.—Showing the progressive shifting of storm frequency northward from 1900 (near sun-spot minimum) to 1905 (near sun-spot maximum).

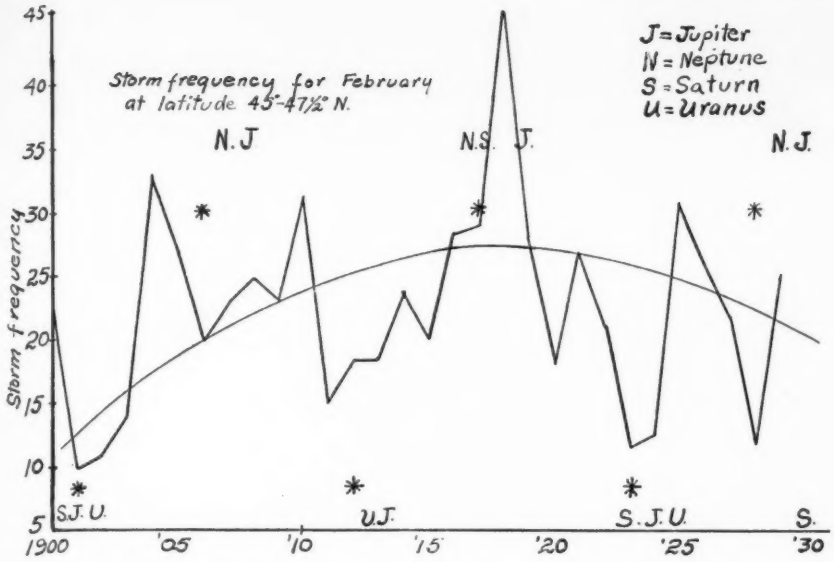


Fig. 13.—Graph showing storm frequencies from 1900 to 1929 at lat. 45°-47½° N. for the month of February. The solid curved line shows Saturn's period. The position of the major planets is indicated by the capitals. Those at the bottom are south of the equator and those at the top are north. The asterisks at the bottom correspond to times of sun-spot minima and at the top to times of sun-spot maxima.

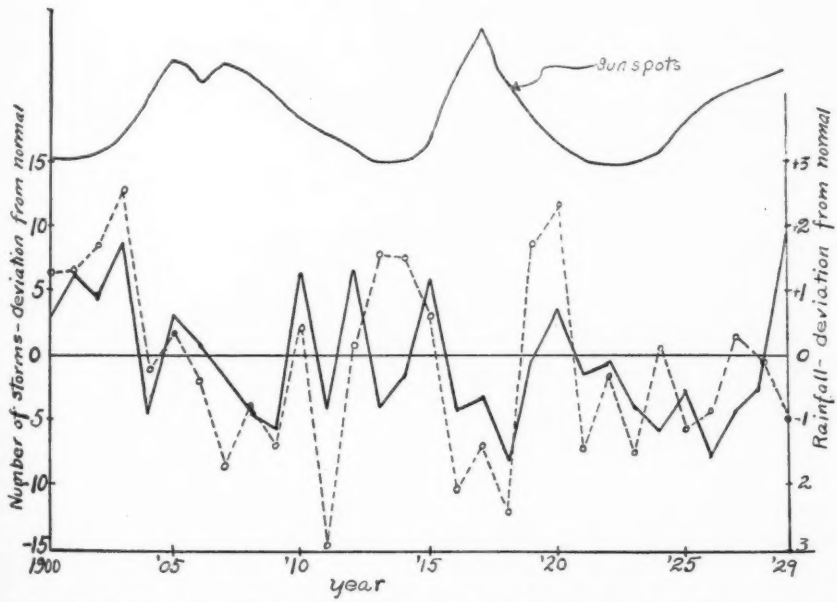


Fig. 14.—Deviation of storm frequency from normal for February 1900 to 1929 from lat. 30°-32½° N. (solid line) and deviation of rainfall from normal for Florida over the same period. The general form of the sun-spot curve is shown above. The tendency for lean rainfall at times of sun-spot maxima is clearly shown.

put out in mimegraph form. The forecast was, on the whole, satisfactory. Then, for December, 1930, and January and February, 1931, a detailed forecast, usually grouping two, three or more days together, was issued thirty days in advance. Two main elements were incorporated: (1) an indication of when to expect high or low barometric pressure in Florida, and (2) when to expect rain or cold. This slide (Fig. 19) shows the actual barometric readings taken from a barograph at the Station and superimposed thereon the forecast for the ninety-day period. The score was between eighty-five and ninety per cent.

In Fig. 20 we have shown the daily minimum temperature readings for Gainesville, together with the rainfall in inches (a mean of twenty-three northeast Florida Stations). The small squares show the times when the forecast did not agree with the recorded temperatures and the round disc show the points where the rainfall forecast failed. On this basis the score was near ninety per cent correct—somewhat better for temperature than for rainfall.

During 1929-30, no formal printed forecasts were issued but a verbal forecast weeks in advance was made by the speaker to Station employees and other friends. A check on the predicted and recorded cold spells that winter shows that fifteen out of sixteen materialized—the majority coming on the days indicated and none of them more than forty-eight hours off. Considering the variables with which we must deal, such as speed of storm movement, storm direction, planetary, moon and sun positions and terrestrial disturbances, the record seems worthy of consideration. In April, 1927, before this Society, the speaker indicated a belief in cold weather for the following year which was amply justified, and this year (1930-31) was forecast as a cold one in Florida. While no records for minimum temperatures have been broken this winter, the mean monthly temperatures for December until now have been very low. The one prognostication where the lowest temperatures of the year were predicted for Florida—i. e., between January 20 and 25—was in our opinion verified, since the lowest temperature for the past three years or more was recorded at this period in South Florida, according to press reports, quoting Mr. Gray of the Miami Weather Bureau.

We deem it unwise to predict what the next decade or two may be like in Florida, but we venture our firm conviction that, after Saturn gets out of the South, about seven years hence, we shall have a series of ten or fifteen or twenty years of relatively mild winters such as existed from 1870 to 1890 (See Fig.). There will no doubt be variations such as we have experienced at other times when Saturn was in the North, especially when it reaches a position 95°-130° heliocentric longitude (about fourteen to sixteen years hence (See Fig. 1). But, aside from the times when Jupiter makes his pilgrimage into the South (about six years out of each twelve), it is significant to note that no one of the four major planets will be in the South until Neptune slides slowly over the equator, in about fourteen years from now. By that time we hope we may have his pedigree so far as a weather-maker is concerned.

An hypothesis by which these observed relations may be explained dynamically and physically must of necessity wait upon the accumulation of more data. It is sufficient to say that the evidence so far seems to indicate that the planets and the moon and sun influence our weather and other terrestrial phenomena both directly as a result of their relative positions to the earth, and also indirectly through their effect upon solar activity. Whether these are tidal in nature, as the evidence produced by Altar and Schuster seems to indicate, or whether it is an electro-static, electro-magnetic or other electronic effect is not as yet definitely known.

We desire to make it clear that we do not wish to be regarded as "weather prophets." We have simply related here some facts which we believe will lead to scientific long range weather forecasting. Some preliminary work following that of Bigelow on magnetic relations look very promising, and this may be directly related to the shifting of the great highs and lows called the centers of action. It has been repeatedly shown by meteorologists that, if the behavior of these could be foretold, long range weather forecasting would be a reality. Our attempts at forecasting, we re-

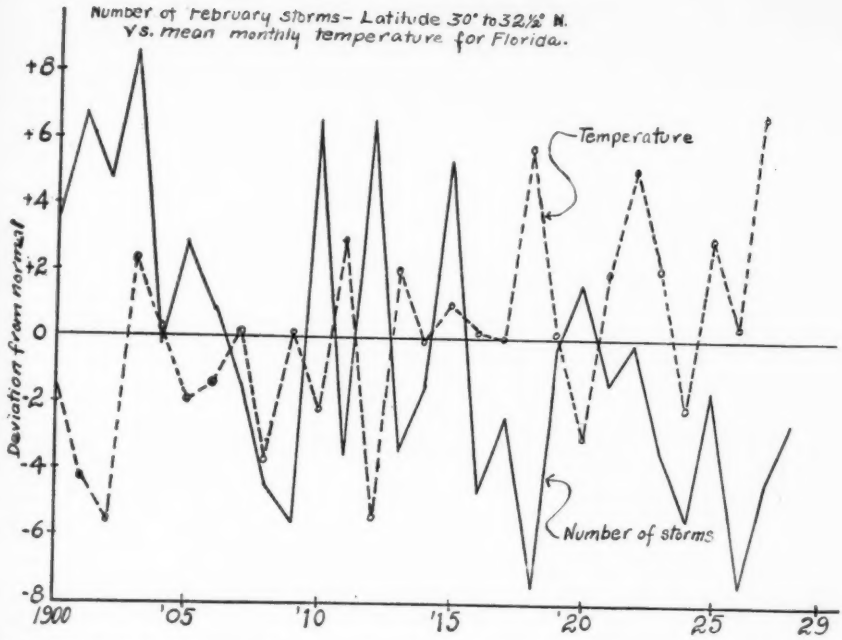


Fig. 15.—Deviation of storm frequency from normal for February, 1900 to 1929 at lat. 30°-32½° N. (solid line) and deviation of mean temperature for Florida over the same period (dash line). Storminess shows a distinct trend from many to few storms while the mean monthly temperature for February has been rising over the same period.

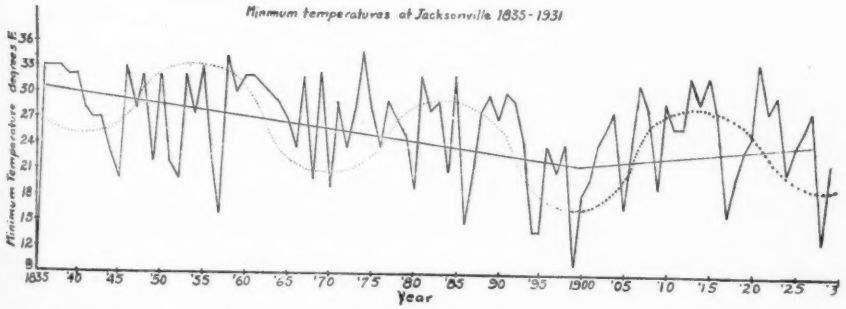


Fig. 16.—Graph of annual absolute minimum temperatures for Jacksonville, Florida, from 1835 to 1929 (solid jagged line). The solid straight line represents roughly the influence of Uranus—the dotted curve shows Saturn's period. The coincidence of the temperature curve with this is evident.

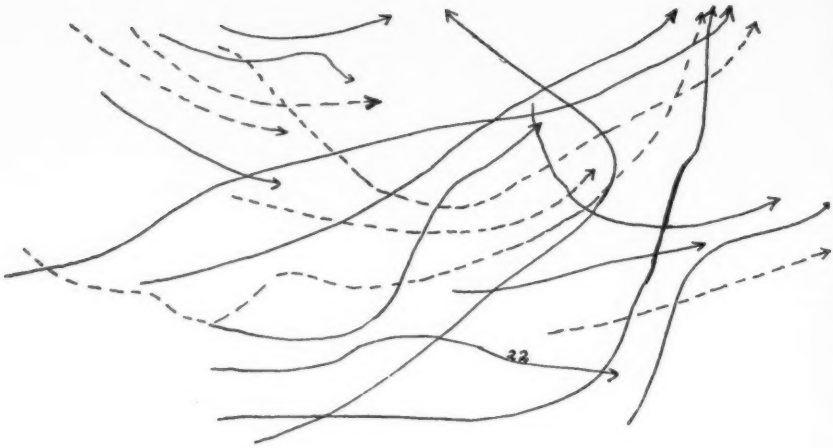


Fig. 17.—Storm tracks (cyclonic) traced from monthly Weather Review, April, 1929. Shows the difference in direction of storms when the moon was north as compared to the south of the earth's equator—a three-day lag allowed.

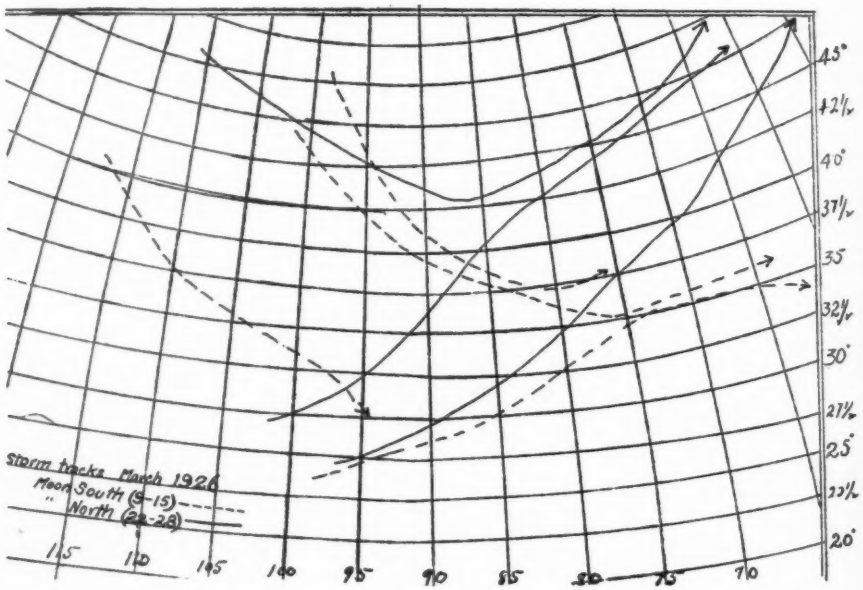


Fig. 18*.—Direction of storm tracks (cyclonic) as taken from Monthly Weather Review, March 1926, between dates indicated.

*These are representative samples of many tracings made of storm track—directions showing what appears to be attributable to lunar influence.

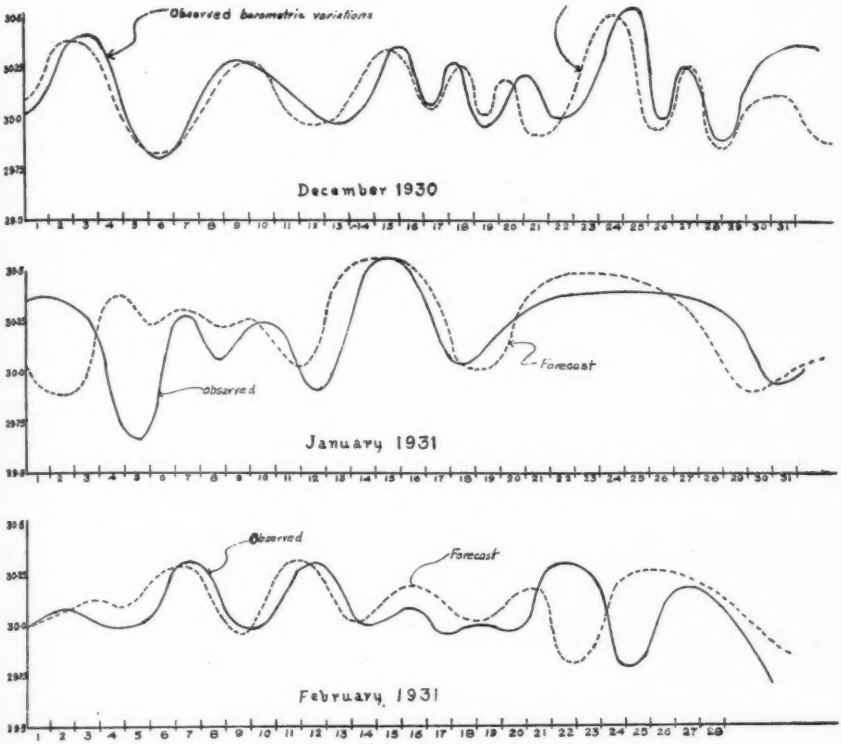


Fig. 19.—Actual and predicted barometric pressure changes from December, 1930, to February, 1931, inclusive.

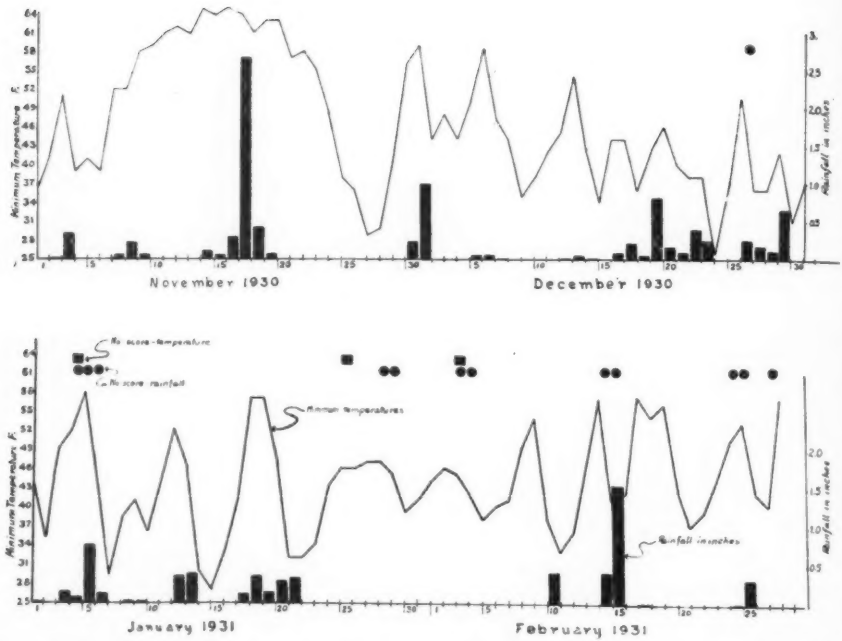


Fig. 20.—Shows daily minimum temperature readings at Gainesville, Florida, for November, and December, 1930, and January and February, 1931, (line curve) and the mean precipitation for 23 N. E. Florida stations. The squares above each curve shows the times when the cold weather recorded did not agree with that predicted. The discs show the times when the rainfall prediction failed.

gard as trials by which mistakes may be discovered as well as the possible reasons for them.

L. B. Skinner, Dunedin: I would like to ask one question. I would like to ask if any observations have ever been made as to cold spells as related to the moon, when it seems to rise and set so far in the North. I have heard men say that whenever the moon rose and set a good long ways to the North, look out for cold weather.

Dr. M. R. Ensign: That whole question has not been thoroughly worked out. We realize that there is a period of approximately eighteen and six-tenths years which is the cycle for the moon shifting North and South, and this is one variable which may have to be considered, and may have an important bearing.

Member: You don't mention any connection with hurricanes?

Dr. M. R. Ensign: The time we have had to spend on this has made it impossible to get to the hurricanes any. I feel positive, from a preliminary survey that we will be able to get some information relative to their occurrence.

L. B. Skinner: Is there any way of determining whether the moon will be far north in any certain year?

Dr. M. R. Ensign: Yes sir, it follows the eighteen and six-tenths year cycle, and that is very definitely known. It is related to the eclipse of the moon. When that time occurs the path of the moon and sun are practically on the ecliptic, and we have a few days either north or south of that particular track.

ANNOUNCEMENT

Mrs. E. L. Lord: Your Chairman has kindly given me permission to bring before you the activities of the Florida State Rose Society. Perhaps you didn't know such an organization existed, but some five years ago we organized under the wing of your society, and since then have been holding yearly meetings, with a rose show as an attraction. This year the Rose Show is being held in the lounge of this hotel, and we hope you will find it worth seeing. Tomorrow afternoon we are holding our sixth annual meeting, and have secured H. Harold Hume to be the chief speaker.

Your own Mr. Coe is telling us something about using roses in Landscape, making pictures of them, and there will be speakers from the various sections of the State; one person from each district will tell you something of how roses are grown in that section. We want to cordially invite you to attend our meeting and find out how your step-child is coming along.

INSECTS AND MITES ATTACKING CITRUS TREES IN HAWAII

By W. W. Yothers, Bureau of Entomology, Orlando, Florida, and Arthur C. Mason, Bureau of Entomology, Honolulu, Hawaii

In October, 1929, the senior writer was detailed by the United States Department of Agriculture to carry on special research work on the Mediterranean Fruit Fly, in the Hawaiian Islands. The following notes and observations were made incidental to the main problems. Our interest, extending over many years, in pests attacking citrus trees in Florida and elsewhere, furnished the inspiration to observe the pests on citrus trees in Hawaii. Some subsequent observations and notes have been added by the junior writer.

LOCATION OF THE HAWAIIAN ISLANDS

The Hawaiian Islands are approximately 2,100 miles southwest of San Francisco, or about one-third of the distance across the Pacific. They are in the same latitude as Cuba, Porto Rico, Jamaica

and the Dominican Republic, and extend from 19° to 22° North Latitude. This is considerable south of either Florida or California.

CLIMATE

Owing to the latitude of the Islands, the climate may be said to be quite tropical. It is much more so than that of either Florida or California, where large citrus acreages occur. Only very general statements regarding the rainfall and temperature can be made since these are very variable, depending upon elevation and location in reference to the rain-bearing winds. At sea level the annual temperatures usually range between 60° and 80°, with extremes of 53° and 87°. Daily ranges are usually about 10°. While snow falls and frosts may occur at the summits of the highest mountains, these climatic conditions never occur at lower elevations. In the greatest part of the entire group frost never takes place. The rainfall is heaviest on the leeward slopes of the mountains and near their summits. In one place the rainfall is over 600 inches; in another, at 5,000 feet elevation, the rainfall is 300 inches, while five miles distant leeward on the seashore, it is only fifteen inches. In several other localities the rainfall is only about six inches on the average, and in dry years practically nothing. Such localities are practically desert. In the greater portion of the Islands the climate is warm, humid, and exceedingly agreeable.

EXTENT OF THE CITRUS INDUSTRY

From the standpoint of production in California or Florida, there is no citrus industry in the Hawaiian Islands. In fact, practically all the citrus fruit used in the Islands is shipped from California. There are, however, numbers of dooryard trees for home use and a few small groves. The largest planting is the Ackerman Grove at Kealakekua, on the Kona Coast of the Island of Hawaii. This consists of about 350 large sweet seedling trees. As near as could be determined, the trees in this grove are about a hundred years old. It is a matter of record that Vancouver brought citrus trees from Tahiti over 135 years ago, and it may be that since this grove is not far from the place where Vancouver landed, these trees are some of the identical trees, or, at any rate, direct descendants of those introduced by him. The general appearance of the trees is very similar to the large seedlings in Florida. The flavor of the fruit is somewhat flat, but otherwise is quite similar to that of the Florida seedings. If ample fertilizer and care were given, no doubt the fruit from the two distant localities would be almost identical.

There is another small grove, consisting of about forty trees, a few miles distant near Capt. Cook on the main road leading down the mountain. On the Island of Oahu, near Honolulu, is a satsuma grove of about three acres. Then the experimental grove at the Hawaii Experiment Station in Honolulu contains a miscellaneous collection of about 200 trees. Other than these properties the citrus plantings consist of a few trees around homes, and along streets and highways.

PESTS PRESENT

Citrus Rust Mite, *Phyllocoptes oleivorus* Ashm.—This mite may be found on almost every citrus tree in the Islands. It was quite abundant in the Ackerman Grove, where about thirty per cent of the fruits were russet. The blemish was identical to that following rust mite attack in Florida. This leads us to believe that since these trees, or their immediate ancestors, came from Tahiti, the rust mite may be there also. The injury on rough lemon and limes is also similar to that found in Florida. On a rough lemon tree just below the Paris Hotel at Capt. Cook, the rust mites were so abundant in November, 1929, that the limbs had become a purplish blue and even the leaves were rusty. There were literally thousands of adult mites, nymphs and eggs present. On limes in Honolulu the mites had caused the characteristic injury called "silver scurf" or "shark skin." In the small grove of forty trees near Capt. Cook the fruit on some of the trees was 100 per cent russet, while other trees had scarcely any russeting. Rust mites were numerous on the citrus trees growing in the grounds of the Central Union Church, Honolulu, some of the oranges being almost blue. All the varieties of citrus at the Experiment Station are attacked by

them. The mite would no doubt prove as serious a pest here as in Florida if there was commercial planting of citrus present.

Purple Mite, (*Tetranychus citri*, McG.)—This red spider no doubt is present on citrus trees in every part of the territory at different seasons. It was observed in November on sweet seedling oranges on the road from Capt. Cook to Napoopoo, where females, males, nymphs, and eggs were found. The injury was, of course, identical with that in Florida. In August the mites were found on practically every tree examined around Honolulu.

Six-Spotted Red Spider, *T. sexmaculatus.*—Although extensive search was made for this red spider, none was found. In Florida this species is present on citrus trees only in the Spring, and it is most difficult to locate any at other seasons of the year. It may be that in Hawaii the same conditions exist. Search should be made for it in early spring instead of during fall and winter.

Tennuipalpus irritans.—This species of red spider was abundant on sweet seedling trees near Capt. Cook in the same little grove where the purple mite was so plentiful. It also occurs on citrus trees around Honolulu. Only two or three instances of injury from the species have ever been observed in Florida. The same may be said of it in Hawaii where it can usually be found in small numbers.

Purple Scale, *Lepidosaphes beekii.*—This scale is everywhere present on citrus trees but usually not abundant. In the Ackerman Grove at Kona they were so scarce that little importance could be attributed to their injury. These trees have never been given any treatment such as spraying or fumigation. Neither was it evident that the entomogenous fungi had been active, only three pustules of the red fungus *Sphaeristilbe coccophila* Tul., being seen. In the Experiment Station grove and the satsuma grove in Kalihi Valley, the scales were much more numerous on the trees. At the latter place both the red fungi and the gray fungi *Ophionectra coccicola* E. & E., was quite abundant on infested limbs growing on the inside of trees or other shaded places. The scales are preyed upon by several species of lady beetles, most common of which is *Curinus coeruleus.* Other coccinellids observed were *Cryptolaemus montroziere, Orcus chalybeus, Lindorus lopanthae* and *Chilocorus circumdatus.* No doubt these predators and the scale fungi are largely responsible for holding the insects in check. Internal parasites also contribute to their destruction.

Long Scale *Lepidosaphes gloverii.*—This scale insect was found in small numbers on the trees in the Experiment Station grove. Very little injury should be attributed to it.

Florida Red Scale, *Chrysomphalus aonidum.*—Although not numerous the red scale has been observed on a number of trees about Honolulu, and is present in the groves at the Experiment Station and Kalihi Valley. It was not seen on citrus trees at Kona.

California Red Scale, *C. aurantii.*—This red scale also occurs in the two groves mentioned above, and is more numerous than the Florida Red Scale. Both species of red scale are heavily preyed upon by the coccinellids listed above.

Chaff Scale, *Parlatoria pergandi.*—Slight infestations of this scale are found on the larger limbs and trunks of citrus trees in several places. About the heaviest infestation is on the citrus trees on the grounds of the Central Union Church. Some of the trees at the Experiment Station grove are also well infested. This is the same species that infests the trunks of the lime trees on the Florida Keys, and causes so much damage.

Parlatoria ziziphi.—This scale also occurs in small numbers in several places about Honolulu, mainly on the leaves of citrus trees.

Green Coffee Scale, *Coccus viridis.*—This soft green scale at times becomes so numerous as to make the trees appear black due to sooty mold growing on the honey-dew excreted by it. The satsuma grove referred to is well infested with these insects. They have also been observed in other citrus trees, both around Honolulu, and in Kona. Parasites hold it in check, *Prococophagus orientalis* How., and *Encyrtus Sp.* being the ones most commonly found. This scale occasionally occurs in large numbers on coffee trees in the Kona district. A fungus disease as well as the parasites mentioned help to control it.

Red Wax Scale, *Cerophastes rubens.*—A single specimen of this native wax scale was taken on a

satsuma tree in Kalihi Valley. It occurs commonly on many other plants and trees.

Cottony Cushion Scale, *Icerya purchasi Mask.*—The cottony cushion scale occurs in small numbers wherever citrus trees can be found. It is always held well in control by the Australian lady beetle *Novius cardinalis.*

Mealy Bug, *Pseudococcus filamentosus.*—This mealy bug is also present on nearly all citrus planting examined. It is heavily parasitized and held in check by internal parasites, most important of which is *Aphycus terryi.*

Pseudococcus citriculus, Green.—A single infestation of this mealy bug is known on an orange tree in Manoa Valley, Honolulu.

Black Citrus Aphid, *Toxoptera aurantii.*—This aphid was found in the Ackerman Grove near Capt. Cook. It was not causing any appreciable injury to the trees. It also occurs in the Experiment Station grove in Honolulu. The species causes little or no damage in Florida, and is rarely seen on the trees.

Spirea Aphid, *Aphis spiraciola.*—In 1923, 1924, and 1925 *Aphis spiraciola* caused great damage to many citrus properties in Florida. In low sections in the river valleys the injury was alarming and many people believed the entire citrus industry would be destroyed. Spirea, or bridal wreath, is the primary host plant. This shrub was introduced into the various countries from China. Since the Hawaiian Islands are a sort of midway place between Asia and the United States, it was only logical to believe the spirea would be present and that the green citrus aphid would also occur there. After most extensive inquiries and search, we located one single plant growing in Nuuanu Valley. The aphids were not present on this plant. Further inquiries indicated that spirea is growing at elevations of 2,000 feet or over on the Northeast Coast of the Island of Hawaii. Further search should be made for this insect in the Islands. It is our opinion that the green citrus aphid is present in Hawaii, and also in China, the original home of the primary host plant.

Aleurodes giffardi Kot.—This small sulphur yellow aleurodid occurs in small numbers on most all citrus trees. No appreciable damage is caused by it. The citrus whitefly is not present in Hawaii.

Beetles, Fuller's Rose Beetle, *Pantomorus godmani* is occasionally seen on citrus trees. The larvae feed on the root tips. The Japanese Rose Beetle, *Adoretus sinicus* at times causes some damage to citrus trees by feeding on the leaves.

Cypress Roach *Eleuthroda dytiscoides,* Sew.—The cypress roach often does considerable damage to citrus trees and fruits. They congregate in the fruit clusters while small and produce large irregular scars on the surface of the fruits. The greatest damage is caused by the roaches eating the bark on the limbs and trunks of young trees.

Grasshoppers and Katydids: The large katydid *Holoclora venosa,* and the long-horned grasshopper *Conocephalus saltator* occasionally are seen feeding on the leaves of citrus trees.

Mediterranean Fruit Fly, *Ceratitis capitata,* Wied.—The Mediterranean Fruit Fly infests citrus fruits of most kinds if they remain on the trees until well ripened. Oranges are little attacked until after January 1st. Lemons are immune to infestation, and lime and grapefruit are only rarely attacked. Satsumas and other thin-skinned varieties are usually severely attacked. Sour oranges are the most favored hosts among the citrus varieties, and are always heavily infested.

SOME PLANT INTRODUCTION EXPERIENCES

Dr. David Fairchild, Coconut Grove

I want to confess to a degree of embarrassment in my preparation for presenting before you some experiences of Plant Introduction. I have tried three times to write what I would say to you this evening, and I have these articles for Mr. Floyd if he wants to use them, in the drawer of my desk. They don't any of them appeal to me as likely to be of particular interest to you. I have

had so many experiences with plants that I found I didn't know where to begin. Most of us try to dramatize our lives about something or other, and I think it is a very excellent idea, and if I could convince any one of you this evening that you can get more romance out of plants, if you go at it in the right way, than you can get out of almost any other thing, I would have accomplished what I consider a great purpose.

Suppose we take as an example out of my own experience one single plant species with which you are all, here in Southern Florida, familiar,—the Mango. I sat down at my typewriter with the idea that I would give you a general run of experience in regard to many plants, and I found I had written seventeen pages about the mango, and hadn't closed it up. I assure you, you can get a tremenduous kick out of the mango. At least, I have been able to. My first impression of the mango came when I was a boy of seventeen on the plains of Kansas. The Professor of Horticulture in Kansas was one of the early planters who left the great plains, and came down to Southern Florida in the early eighties, and I used to hear from him as a boy of the place which he called "Mangolia." He was one of these men who romanced the field of plants around him, and he had named his place after the mango.

I found myself, years after, in the Department of Agriculture, during a time when there were only five hundred people in it, and about the time when they were thinking in a very vague way of selling Florida. I never dreamed I would have anything to do with mangos, but I remember in the collection of the Department of Pomology, of which Dr. Van Deman, a name known to some of you older gentlemen, had charge, a little plaster cast of the turpentine mango, with which you are all familiar here. In those days, that was the mango to most everybody who lived in Florida.

The mango was brought into this country probably (although I am not certain) by Henry Perrine, who was the first plant introducer in this part of the world, and one of the first in the United States.

As years went by, I made up my mind to go abroad, and on the steamer I met a very unique person; his name was Barbour Lathrop, of Chicago. He had been all over the world. At that time he had been ten or twelve times around the world, and he had been down the east coast of Africa. In my first conversation with him he told me about a mango which he had eaten while off the coast of Africa. Mr. Lathrop gave me $1000 to go to Java, as a young man, thinking I would spend all my time studying the tropical plants, with the idea of introducing them into this country, although he never told me that was what he was sending me there for. I traveled through Java, but I was more interested in the fungus gardens of the termites than I was in anything else in Java, at that time. I think perhaps Mr. Lathrop thought I was wasting my time studying those fungus gardens, and in the course of time I got a letter from him saying he would be in Java in a few days. He came there and in twenty-four hours switched me over from the fungus gardents of the termites, and started me in this work of plant introduction, and there occurred in his numerous stories of his travels all over the world the story of the Bourbon mango on the east coast of Africa.

I didn't find any good mangos in Java. I saw the mangos of Sumatra and the Malay Peninsula. We went as far as New Guinea, and wherever we went we looked at these mangos, but none of them were red mangos, all of them were yellow mangos. In the course of time, I got to Hawaii, in 1897, the earliest days of Hawaii. When I speak of Hawaii in '97, and then compare conditions with those which were presented to me a few days ago by a man who came from Maui and asked me to suggest a new crop for the Islands, because sugar cane was not sufficiently remunerative, I realize what has happened there. They have already introduced sugar cane, and have come to a point where they want something else.

The Americans in Hawaii have begun to be interested in Mangos, and begun to collect them.

When I got back to Washington I began to hear about the Bourbon mango again, but I also heard always and forever, eternally, the story of the bath-tub. I suppose many of you know that. Its an illuminating story. Its a story everyone should study. It seems incredible that a story of that character should become almost universally known, and prevent so many thousands of people

from ever learning anything about the mango. The Mulgoba had been introduced, and the first trip I made to Florida was in 1898, when Dr. H. J. Webber was in a little Inn known as Peacock Inn, at Coconut Grove, studying the fertilization of Zamia, the plant with which all of you are familiar in southern Florida.

Since then times have changed tremenduously, but the spirit of research which characterized those days in Southern Florida come back to me every now and then, as an example of enthusiasm and freedom from restraint and inner wisdom which it is difficult to reproduce in these days. Old Prof. Elbridge Gale had in his collection the plant of the Mulgoba which looked like a fig tree, branching from the base. In the course of time one of those Mulgobas came to Washington. I don't know whether this interests you, but it created a sensation among those of us who knew what fruits were. I was charged then with the office of Plant Introduction and was interested in the tropics and that was about the time of the Spanish War, when America woke up to the existence of the Tropics. With great enthusiasm, and with a positive feeling of confidence I thought if I could only get the Secretary of Agriculture to once taste the delicious quality of the Mulgoba mango that he would be more favorably disposed toward the appropriation for the introduction of plants, and he would be more favorably disposed toward the expenditure of some of that money (not a great deal, but some of it) in Southern Florida. I can see him now as he lifted it from my hand and raised it to his nose, with the remark "It's got a curious smell, hasn't it." I never got any further with the Secretary on the mango, and it produced a curious sensation of disappointment and hopelessness, that such a gorgeous thing as this mango was, couldn't even make a dent on as intelligent a man as Secretary Wilson. But it came to me, being in charge of the Office of Plant Introduction, to ransact the world for the Mango. About that time, Mr. Lathrop turned up again, and remarked that I was no more fit to run that Office of Plant Introduction than he was to run a chicken coop.

I drifted off with him again, and we traveled six weeks, and then we began on the Mango. The best mango we found in India—in Balu-Bombay regions, where I spent most of my time, working on mangoes, but there was always in his mind this Bourbon mango. It was a number of years before we got down the east coast of Africa, and illustrating how easy it is to imagine that all you have to do is to land in the country and pick up the fruit and send it in, we had forgotten that perhaps the mango season wouldn't be on when we got to Bourbon. And they said "The mango is all gone; if you had come a week before we would have shown you this wonderful mango." But the Consular agent succeeded in finding two mangos. We photographed them, with great deliberation, and sent the seed home. They came from a little Island off the coast of Africa. The consular agent had a sailing vessel and he said we couldn't stay very long, but when you get away I will go down there and get you the Bourbon mango and send it over. He did, and I congratulated myself on this accomplishment of getting this mango. I says "Mr. Lathrop, don't you think we better name this mango after you?" He says "I am not very anxious to have anything named after me, but there is a good deal of romance connected with it, and its an awful good Mango, Perry," so it was called the Lathrop Mango.

I, of course, waited for results. If any of you try sending budwood from East Africa to America, you will find it takes a long time to come: not only that, but somebody has to be at this end to catch it. The process of budding and grafting the mango hadn't been worked out in those days, and we didn't have, as we do now, my dear old friend, Ed Simmons, prepared as he would be now to catch that and bud it. Sometime, I hope he will tell us just the details, which I have forgotten now, of what happened over here, but I remember with chagrin of going into Mr. Cellon's orchard. He was one of the early horticulturists here, one of the most skillful in the State in the budding of these tropical plants. He met me with the remark "Your Lathrop Mango was so poor and worthless that, although I budded my trees with this mango, I had to bud them all over." I called on him the other day. The Lathrop mango is now a zone of living wood, between the Haden above and the Turpentine stock below. I was disappointed. Mr. Lathrop says "That's always so," but I went to his homestead, and I

saw an interesting mango tree, and I said "What is that mango; that is the largest you have got." He says "That's the Lathrop." I says "I thought the Lathrop had gone out completely." "No," he says, "Its a very small mango, but it's very late, and the boys like it, and its a good mango." I have one now in my place that you visited today, and it is growing well, and may be a useful mango in the long-run.

We started in to get mangos from every part of the world; we got them from Lucknow, Singapore, and many other places, and introduced over eighty varieties. I made another trip out there, and during the expedition which we made up to the Persian Gulf I stopped at Poona, where G. Marshall Woodrow, the great Indian Horticulturist did his work. I found him gone, but learned the method used by him in the grafting of mangos, which was a very crude method of growing the plant in pots and arching it on trees by means of a platform, which is an easy way, and which, by the way, I notice is still the method commonly in use in Java. I was out there three years ago. In those days, Mr. E. N. Reasoner—I am not keeping exact tabs on the dates, perhaps it was earlier than this—Mr. Reasoner had built a tall slat house in which to grow mangos. We didn't think we could grow them down here unless we gave them winter protection, and my friend, Ed Simmons, had a slat house where we put all these varieties we brought in. When I first came to Florida to see this mango, it shot through the slat house, and we became convinced we could take the slats off and grow these mangos down here, but we had a lot to learn about the mango. We thought all we had to do was to get these varieties, prescribed over there in India as the best, the finest and with the most impossible names to pronounce, and that these would thrive and be the same here as over there. After twenty-five years, some of those mangoes have never fruited at all; others were very poor bearers, and some were perfectly delicious.

There came a time when the Mango began to drift up to Washington. I thought I would try again to get another Secretary interested. I gave him one of these delicious mangos. He took it home in the summertime and confessed to me two or three years afterwards that he and his colleagues had been sitting in the room late in the evening, and detected a curious smell, and he says "We debated for sometime whether any of us were brave enough to tackle that smell, but finally we did, and it was very good indeed."

But it occurred to me (and this is the lesson I would like to leave tonight), that I was making a great mistake to put so much faith in my superior officer as a dictator with regard to the quality of the mango. He was, after all, only another individual, and if he didn't like it, perhaps there were ten others who would like it. So with the mangos at my disposition I attacked the Cosmos Club, where I was a member. I had a slip made, asking for the opinion of each person with regard to the mango which he ate, and when I came to the result I had about eighty per cent state it was perfectly delicious and some said it wasn't fit to eat. I felt a good deal better after that, and I assure you that the encouragement which you get by spreading out your inquiry with regard to quality of a fruit, or anything else, is a substantial encouragement. I think every one of you must have been conscious of having brought into the presence of somebody a thing that you particularly admire or like, and had them turn a cold shoulder on it, and you feel you have had the unpleasant experience of a cold douche.

Now out of these mangos which we have introduced, there have not emerged anything like a large percentage. I have just been over figures with regard to the mango, and if we get ten per cent of them that are worthy of places in the private collection I think we will do well.

But another thing has happened, which is really more significant than merely the bringing in of these varieties—the emergence, speaking in a genetic sense—of the Haden Mango. Most of you are familiar with hereditary matters, and I presume most of you realize there hasn't been a great deal of breeding of mangos in Florida, but notwithstanding the small amount that we have done, there has come into existence down here a mango which is more beautiful, I believe, than any other mango in the world. I am not absolutely positive of this, but I have seen sketches of colored pictures that have been made in India of a great many varieties; I have read descriptions of over a hundred varieties of these mangos, and

they do not have this gorgeous color which we have in the Haden Mango, which originated in Coconut Grove. The original tree is still standing there. That's a very significant thing, ladies and gentlemen, because it may be what it is because of our breeding and selecting of these mangos, and my old friend, Mr. Simmons, has some very interesting ones down the line, which I hope you will be able to see, some of you, tomorrow, and we hope by breeding and selection that we shall be able to produce here in Florida a finer mango than they can in the more moist tropics.

You see the mango, while it grows everywhere, in the dripping rains, the forests of the tropics, and elsewhere, it does not fruit there properly. I believe today we can grow a finer mango than can ever be grown in the Panama, and as fine, perhaps finer, than in Porto Rico. Certainly I have not found anything in Java that compares with it, and even the finest of the Indian mangos are no more delicious than the mangos grown here.

With air transportation its going to be possible, I believe to get a more careful comparison, but to illustrate how difficult it is to make up your mind with regard to the quality of the mango, I must tell you of an incident that happened to me in the Pullman train from Washington to Boston. One of our finest Indian mangos had fruited, and Ed Simmons had sent me the crop from the tree, and I thought it would be a good plan to interest the manager of the biggest hotel in Boston, in a good mango. I put these in my suitcase and was on the way to Boston. On the train was a neighbor, a partner, at one time of our embassador Mr. Herrick, and the conversation drifted on these tropical fruits, and upon the mango. He said he had been all through India, and he didn't think the mango was really fit to eat; that it was a most over-rated fruit. I said "I don't believe you have ever eaten a good mango." He said "I have been all through India, and I ought to know what a mango is." I says "I have seen some pretty poor mangos in India; let me give you one." I fished out of my suitcase a beautiful mango, delicate and thin-skinned, a delicious mango. We were having lunch at the time. He opened it, tasted it, and says "I never tasted anything like this." He says "I don't understand it; I was all through there" I says "You probably got what was given you at the hotels, stringy and worthless; that Mango was given me by Mr. Tatta, of Bombay, who had given me this collection, on my way back from the Persian Gulf, and that represents one of the finest mangos in India, because he had a great mango collection, and that's what he gave me as the finest." Parmalee says "Tatta! I know him. I was delegated to show him all over America hunting for mining machinery, and I was delegated by Herrick to take him to San Francisco, and you mean to say this was given you by him?" I says "Yes, five years ago."

The time has come, and has long since come for me to close this rambling talk on the mango. I have many friends who still feel I am wasting my time with the mango. I have a friend who every time he comes here on his way to Cuba says "What are you playing with this old worthless fruit for," but I still insist, ladies and gentlemen, that the mango has distinctive possibilities, and for this reason you will find old trees scattered across this southern end of the State, which will give you some indication of their resistance to cold, and in that area it behooves us, it seems to me, to develop through the breeding and selection of the forms which are still living in different parts of this southern part of Florida new types, new strains, and to study the stocks on which they are to be grafted. We have some new ones coming from Java and others from the Phillipines, and Mr. Simmons has already some very interesting seedling stocks. In other words, this whole question of the mango will have to be worked out here. It won't be worked out in the tropics, and when I consider the amount of money and time given into the development of such an industry as the date industry in California, I am ashamed that I haven't been able to put more money into the study and development of this one fruit which has meant so much to me in the way of romance and interest and taken me to so many parts of the world in the search of it. Its a great fruit, and I hope this year that there will be at least half a crop, and if you don't like it, then learn to.

UTILIZATION OF CITRUS FRUITS

By Flavia Gleason, State Home Demonstration Agent, Tallahassee, Fla.

The use of citrus fruit as an indispensable article of food has increased of late years by leaps and bounds. The common practice of giving even infants orange juice is a radical change from Robert Louis Stenenson's time—when

"Every day, if I've been good
I have an orange after food."

The modern youngster in all well regulated families begins his day with orange or grapefruit —irrespective of good or bad behavior.

A few of the more important health-giving properties of citrus fruits to which medical authorities call our attention are:

First—There is no more refreshing cooling drink for human beings, sick or well, than, orange, grapefruit, or lemon juice.

Second—Citrus fruits contain a fair proportion of vitamins in a form very beneficial to young and old, being slightly laxative and of a flavor relished by all. The juices should be used extensively in every family by every member.

Third—Citric Acid and Citrates are oxidized in the blood and tissues into the carbonates which help greatly in maintaining the normal alkaline reserve of the blood.

Fourth—We are told that as a germicide lemon juice stands very highly. An eminent physician states that he uses it largely in all forms of sore throat, even with diptheria, with excellent results. It has been found that one-half of one per cent of Citric Acid is so poisonous to the cholera germ as to make impure water to which it is added perfectly safe to drink. It is for this reason that we are advised when on camping trips, to use lime juice or lemon juice in the drinking water for safety.

Fifth—Their anti-scorbutic property is well known. Limes and lemons have been used for centuries to prevent scurvy. Vitamin C which prevents scurvy, also appears necessary for normal growth and for the prevention of tooth decay. It is particularly abundant in Citrus fruits. The body is limited in capacity to store Vitamin C, so that the diet for all ages, but especially in childhood, should contain it in abundance. Three essential food elements must be included in the diet to insure normal teeth. These are the necessary minerals, Vitamin C and Vitamin D. If any one of the three is lacking there can be but one result and that is unsound teeth that quickly decay.

It is not natural for teeth to decay. We are told that:—"Diet can practically prevent decay and if diet is a factor in dental disorders, Vitamin C is probably the most important constituent." Tests on human beings have shown that it requires as much as a pint of orange juice a day to provide a sufficient amount of Vitamin C. Dietitians tell us we should use at least one pound of fresh raw fruit or vegetables, or those especially canned, every day to provide Vitamin C. The amount of vitamin required appears to be very much greater than we have heretofore suspected." There are cases on record of people suffering from pyorrhoea showed that the diet had been very deficient in Vitamin C. These patients placed on a diet containing an abundance of this vitamin, as well as calcium and phosphorous, showed steady improvement and cure.

We should take a pint of orange juice daily for Vitamin C and calcium, if for no other purpose.

Sixth—Being pleasant to the palate, beneficial to health and within the limits of every purse, every one should eat more oranges and grapefruit.

It is an ill wind that blows no good. The large citrus crop this year and the low prices have made it possible for many people to enjoy more of our delicious fruits than ever before, I believe. I know that this is true at our own Florida State College for Women, where 1,000 girls have their meals throughout the school year. Since November, the dietitians there have served 850 field boxes of grapefruit and 508 field boxes

of oranges. They have 100 boxes of grapefruit in storage at this time. This is considerable more than they can ordinarily buy in that length of time. In addition to the fresh fruit they have used 150 cases of canned grapefruit No. 5 cans and 75 cases of canned grapefruit juice in No. 5 cans.

Our citrus fruits are seasonal and only available for limited periods. It is in this connection that canning plays an important part in meeting dietary needs as well as saving the surplus. "Canning is the art of preserving seasonal products and others susceptible to rapid spoilage, as far as possible in their natural state with all their nutrient qualities intact, and in a form which renders such products more or less stable and capable of being distributed at all times to all places. In so far as the art approaches perfection it becomes an ideal way to supply such products out of season."

Raw fruits and vegetables have been found to lose in vitamin content on storage. Canned foods have three distinct advantages from the standpoint of their vitamins:

1—They are always canned promptly after harvesting. The home demonstration agent's slogan is one hour from field or garden to the can.

2—Oxidation, which destroys the vitamins, is not permitted to take place in commercial canning or the best methods of home canning, as it does in open kettle cooking.

3—After canning, the vitamins in canned foods are apparently stable and may be stored for long periods with insignificant or no loss.

It is only within the last few years that grapefruit canning has come into prominence. In addition to commercial canners, home demonstration agents with women and girls under their direction, have canned thousands of cans of grapefruit this year that their families may enjoy a varied diet all the year.

For the same reason and to aid in conserving the surplus, other surplus citrus fruits have been converted into preserves, jellies, jams and marmalades. Standardization and marketing of these products have been the means of increasing the family income in a good many instances.

We are all exteremely interested in the frozen orange juice adventure. With eminent authorities all over the country proclaiming the virtues of a product that is naturally delicious and reasonably easy to obtain for several months of the year, it would seem that frozen orange juice producers have a market already created for their products.

However, we are faced with the fact that the public has been given highly colored and highly flavored stuff instead of orange juice for a long time. No doubt it will take a lot of educational work to bring a large per cent of the people to the point of demanding pure orange juice, especially if it lacks some of the color and flavor of its artificial competitor.

Along with other uses, the home demonstration workers are stressing the use of citrus by-products in baking—orange bread, for instance, instead of raisin bread—fruit cakes made from our own fruits instead of imported ones. We believe that the orange pie can become as popular as lemon pie. The public can create a demand which will popularize delicious food stuffs which we produce in such abundance—popularize it above any of the imported products or substitutes.

Nothing worth while just happens. It must be brought about. It is the duty of all of us to bring about an increased utilization of citrus fruits—first, because of their health giving properties; and second, because of financial income resulting from their production and utilization.

SUN RAYS AND PLANT LIFE

Dr. Otto Sieplein, University of Miami, Coral Gables

Sunshine as it reaches the earth is composed of a great variety of radiations which are classed by scientists according to their wave lengths. For convenience they are considered in octaves similar to the classification of sounds in music. Most commonly we note the light, next most commonly heat, and occasionly we observe the photographic or chemical effect. The heat rays, frequently referred to as infra-red, constitute six octaves in the sun ray scale, and are the long waves corresponding to the sounds of low pitch. The chemical rays, usually called ultraviolet, constitute half an octave, and are those of the shortest wavelengths. Between the infra-red and the ultraviolet is one octave which includes lights of all the various colors, ranging from the red rays which are longest through yellow, green, blue, to the short rays of violet colored light. About two-thirds of the sun energy we receive is heat, about one-third is light, and ultra-violet makes up about two per cent.

All animal and plant life has developed under the influence of the sun, and therefore we may consider the production of the various colors by plants and animals as a means of tuning themselves to the rays which are most beneficial in stimulating the particular process going on in that plant or animal, or in the particular organ. In other words, there is every reason to believe that the green of the leaves tunes those plant organs to the rays best fitted to develop a plant structure; that the various colors of the various flowers control the processes of building fruit and seed.

It is only in the last few years that experimenters have been dealing with the question: "What part of the sun's rays are most beneficial for a plant, and what part are injurious?" The attention of experimenters on plants was awakened many years after physicians had begun to learn something of the effects of different rays on the human body. There have been two investigations of definite importance on plants. One of these at the University of Vermont has dealt with sunflowers grown under various glasses and cheese cloth, using five different kinds of glass and three tests with cheese cloth in one, two, and three thicknesses, respectively. The results of growth showed that under white glass or one thickness of cheese cloth the plants had grown about seven-eighths of the size reached in the open. Less growth was shown under green, orange, red, and blue, glasses; blue glass showing about one-fifth of normal growth and a growth comparable with that under three thicknesses of cheese cloth. Measurements of sun energy in the various test plots showed that the decrease of growth matches closely the decrease of sun energy as affected by the various screening glasses and cloths. A very marked characteristic of all the plants under low intensity is small leaves which are abnormally elongated, carried on long stems, and deficient in the green coloring matter, chlorophyl; some of the leaf stems are nearly white.

The other set of experiments was carried on at the Boyce Thompson Institute. Tomatoes and four o'clocks were grown in special houses in which the length of day and kind of light could both be controlled. By artificial means the equivalent of full sunlight could be given the plants up to twenty-four hours of the day. Tomato plants do very well in a day of at least nine hours or less than fifteen. The development in a five-hour day or an eighteen-hour day is poor; in a twenty-one hour day it is very poor; while a twenty-four hour day kills the plant. For these two species there was no effect on the growth, on the production of leaves, or on the production of chlorophyl, when the ultra-violet rays were screened out; that is, ultra-violet plays no part in building chlorophyl. Experiments at the University of Arizona corroborate these results.

Quite a number of experimenters have grown plants under over-dosage with ultra-violet, and invariably the result has been to develop smaller leaves (frequently more rounded than normal). These are carried on short stems, and show a

very marked increase of thickness and intensity of green color. For plants like the tomato, dosage with ultra-violet has produced normal or even increased flowering, but has absolutely stopped the setting of fruit. This is entirely in accord with the experience of growers who have repeatedly noted that in South Florida, as summer approaches, tomato plants cease to bear although they may grow and flower quite vigorously. From our observations on Miami sunshine we know that the intensity of ultra-violet in May is at least twice that of early January. The prevalence of thick leaves of tropic and subtropic plants is Nature's protection for the active cells of the leaves from the intense ultra-violet of tropic sunshine.

Although there seems to be no need of ultra-violet in the building of normal leaves, there is a definite part played in the building of fruit, and in the manufacturing of special materials by certain plants. Ordinary glass permits no ultra-violet to pass through to the plants in the common plant-house. Tomatoes grown under glass lack some of the firmness that they have when grown in open sun. More importantly, they distinctly lack vitamins; this means that one of the largest contributions which tomatoes make to the diet is lacking when they are grown under glass. Dr. Baly of Manchester, England, has produced sugar in the laboratory by the use of ultra-violet. Parisian scientists have grown strawberries with artificial ultra-violet. In both cases the product has been entirely satisfactory, but the sugar cost at least $100 an ounce, and the strawberries at least $5 apiece. The experiments show that ultra-violet plays a large part in these processes, but South Florida is producing sugar from solar ultra-violet at a cost of considerably less than one cent a pound, and all Florida is producing strawberries at a cost far below that to the Parisian scientists.

Florida, even in its northern part is considerably nearer the equator than other agricultural regions, and in this southern part is almost within the tropics. The intensity of our sunshine varies less during the year and day than in any other region of the United States. In the lower half of the state we are surrounded by the warm waters of the Gulf and Gulf Stream. During a majority of the day and year we have continuous breezes from the east over the whole state. Our rainfall is larger than that of most any of the agricultural regions of the country; our rainy season is in the summer months. In the consideration of every climatic factor we are placed under rather unique conditions. Surely this means that in order to make the most of our position we must learn to work with, and take advantage of, these unique conditions. It places us under the responsibility of applying the horticultural and botanical knowledge from other parts of the country, first recognizing the uniqueness of our position and then developing the special technique required by those conditions. If we approach this job with open minds, open eyes, and willing hands, we can learn how to adapt the basic agricultural knowledge to subtropic conditions and thus be leaders in the work of the human race for this century: the making of the tropics fit for the white man.

LANDSCAPE MATERIAL INDIGENOUS TO TROPIC FLORIDA

K. Dahlberg, Division of Parks, Miami, Florida

We are all agreed, I hope, that landscape designing is an art, but few of us realize its magnitude. When we begin to explore its possibilities for expressing beauty—for transmitting ecstacy, as the most up-to-date definition has it—then we are forced to the conclusion that landscape designing is at least as great an art as architecture, and greater than both painting and sculpture. We also find that it is infinitely more difficult. For while the medium of those more thoroughly explored—and exploited—forms of art is static, the medium of landscape designing is highly dyna-

mic; it is alive and ever changing. When we express an idea in paint, or marble, or structural steel, our labor is finished when the job is done; but when we try to express an idea in growing plants our work has barely commenced when the planting is finished. It will take months, years, sometimes centuries of painstaking attention to detail, before the vision of the artist is fully realized.

When the average person thinks of landscaping, he thinks mostly in terms of color. If form is considered at all, it is only considered as it pertains to individual specimens. The idea of creating a beautiful picture, a symphony in living plants, rarely enters his mind. He wants a collection of plants that he likes, and he substitutes the striking, even the grotesque, for the beautiful, to an extent that we hardly realize. He does not know there is such a thing as texture in landscape material; and even his sense of color relation is hazy, or worse.

Only through an education in esthetics do we become aware that harmony in texture is quite as important as color harmony. The ever widening search for desirable landscape material, carried on by the leaders of the profession, resolves itself very largely into a search for new values, or better values, in texture. And here we, citizens and lovers of Tropic Florida, stumble onto a remarkable fact: right in our backyards, so to speak, there is a veritable treasure house full of material which in beauty, character and elegance, surpasses the best of the exotics we have been propagating. Having made this discovery, the Division of Parks of the City of Miami began to experiment with this material, and the results have surpassed our expectations. During the last couple of years we have brought some sixty or seventy wild species under cultivation, and we are constantly widening the field.

Of course, you have already guessed that I am now speaking of that plant association, almost entirely West Indian in character, which once covered the Florida Keys and the rim of that oolithic limestone saucer, the Everglades, from Palm Beach to Cape Sable, and around the Cape up to Fort Myers—in other words: Tropic Florida. For that is all there is of Tropic Florida. And it is fairly certain that up to a century ago most of this region was one vast primeval hammock.

But settlers brougt axe and fire. And presently some utilitarian fanatic conceived a scheme to drain Tropic Florida's life-blood out of the Everglades, converting the most remarkable wild life sanctuary the world had ever seen into a desert waste of burning peat and charred quicksand or marl, in many places too thin to even hide the rock underneath. For such is the ultimate fate of the Everglades country under the present drainage system. Hammock after hammock, with the fertility that it took long, slow centuries to build up, has disappeared overnight, until there is now left just a few pitiful remnants of the former glory. Such a remnant is Matheson's Hammock, the first stop on the itinerary of our Friday morning motorcade. There you will see under natural conditions a good many of the species in which I now shall try to interest you.

For the sake of convenience we will divide our material into three classes: Beach species, Hammock species, and "Scrub" species. Mr. Murray, Ass't. Sup't. of Parks, will assist in picking out and passing along these specimens, which I collected in Brickell Hammock yesterday morning. Let us start with the Beach assemblage; to us Dadeans that is, perhaps, the most important one.

1ST.—SALT-WATER ASSEMBLAGE

Trees or Tall Shrubs:

Avicennia nitida—Black Mangrove.
Conocarpus erectus—Buttonwood.
Laguncularia racemosa—White Mangrove. (Will grow on top of the dune almost as well as in the salt-water marsh).
Rhizophora Mangle—Red Mangrove. (For marsh only).

Large Shrubs:

Paritium tiliaceum—Seaside Mahoe. (Forms vast, low, tidal jungles).
Coccolobis uvifera—Sea-grape. (Remarkably beautiful foliage).
Torrubia longifolia—Blolly.

Medium Shrubs:

Suriana maritima—Bay-cedar.

Vachellia farnesiana—Popinac. (Exquisitely fragrant).
Eugenia buxifolia — Spanish Stopper. (Very choice).
Casasia clusiaefolia—Seven-year Apple. (Bold, glossy foliage. Fragrant).
Sophora tomentosa—
Baccharis angustifolia — Sea-myrtle. (Very beautiful, but unfortunately very common).
Baccharis glomeruliflora—Salt-bush.

Dwarf Shrubs:
Chrysobalanus Icaco—Dwarf Cocoplum. (Very choice).
Tournefortia gnaphalioides—Sea-lavender. (Exquisite).
Lantana depressa—Dwarf Lantana. (A gem: Fragrant).
Lycium carolinianum—Box-thorn.
Borrichia frutescens—Sea-marigolds.
Borrichia arborescens—Sea-marigolds.
Borrichia glabrescens—Sea-marigolds.

Vines:
Dalbergia Ecastophyllum—(Very rampant).
Guilandina crista, G. Bonduc, G. Bonducella—Nicker-beans.—(Burglar-proof fence).
Rhabdadenia biflora—
Acanthocereus floridanus—Dildoe—(Reenforces the Guilandinas).
Mucuna urens—Sea-bean. (Very fine when in bloom).
Pharbitis cathartica — Morning-glory (Very lovely).
Calonyction Tuba, C. aculeatum—Moonvines.

Palms:
Thrinax Wendlandiana—Thatch-palm. (Elegant subject).
Serenoa repens—Saw-palmetto (The ash-gray form especially fine).
Sabal Palmetto—Cabbage-palm. (Needs no introduction).

Herbaceous or Fleshy Perennials:
Croton punctatum—(Silver-gray foliage).
Hymenocallis caribaea—Tall Spider-lily.
Uniola panisulata—Seaside Oats.
Ignota sp.—Blue Dune-grass (Conquers moving dunes).
Yucca aloefolia—Spanish Bayonet. (Wonderful subject, when in bloom).
Agave neglecta—Century-plant.
Agave rigida—Century-plant.
Agave decipiens—Century-plant.
Opuntia Dillenii—Prickly-pear.
Opuntia keyensis, etc.,—Prickly- pear.
Harrisia Simpsoni—Prickly-apple.
Harrisia Brookei, etc.,—Prickly-apple.
Commelina angustifolia—Dew-flower. (Lovely, but closes at noon).

Ground-covers, more or less Shrubby:
Batis maritima—Saltwort.
Ambrosia hispida—Creeping Ragweed.
Sesuvium portulacastrum—Seaside Purslane.
Ernodea littoralis—

Ground-covers, Herbaceous and Flowering:
Ipomoea stolonifera—Dune Morning-glory.
Ipomoea Pes-caprae—Goatsfoot Morning-glory. (Quickest cover for sandfill).
Canevalia lineata—Jackbean.
Helianthus debilis—Beach Sunflower. (Charming).
Verbena maritima — Beach Verbena. (Very lovely).
Verbena maritima laciniata — Beach Verbena. (Very lovely).
Tribulus cistoides—(Cuban. Very fine).
Crotalaria humilis—Creeping Crotalaria.
Philoxerus vermicularis—(Very fragrant).

2ND.—HAMMOCK ASSEMBLAGE

Trees:
Bursera Simaruba—Gumbo-limbo.
Simaruba glauca—Paradise-tree. (Stands shade. Very beautiful).
Swietenia Mahogani—Mahogany. (The King of the forest).
Bucida Buceras—Jucaro. (Misnamed "Black Olive").
Lysiloma bahamensis—Wild Tamarind. (Very fragrant).
Quercus virginiana — Live-oak. (Too well known to need an introduction).
Magnolia glauca—Sweet-bay. (Does well on swampy land).
Ichthyomethia piscipula—Jamaica Dogwood.
Sapindus Saponaria—Soapberry.
Exothea paniculata—Inkwood. (Likes shade).
Sideroxylum foetidissimum—Mastic.

Chrysophyllum olivaeforme—Satinleaf. (Stands shade. A jewel).
Krugiodendrum ferreum—Ironwood. (Very fine).
Tamala borbonia — Red-bay. (Does well on swampy land).
Misantheca triandra—(Almost extinct in the U. S. A.).
Mimusops emarginata—Wild Dilly.
Dipholis salicifolia—Bustic. (Very fine).
Eugenia confusa—Red Stopper. (Stands full shade. Very beautiful).
Anamomis Simpsoni—Simpson's Stopper. (Very fine).
Coccolobis laurifolia—Pigeon-plum.
Cordia Sebestena—Geiger-tree. (Very showy).
Exostema caribaeum—Princewood.
Celtis mississippiensis—Hackberry. (Deciduous, but very desirable as bird attraction).
Morus rubra—Red Mulberry. (Deciduous, but very desirable as bird attraction).
Pinus caribaea—Caribbean Pine. (One of the most beautiful of all pines).

Large Shrubs or Small Trees:

Citharexylum fruticosum—Fiddlewood. (Very fine shiny foliage. Fragrant).
Clusia rosea and C. flava—(Cuban. Reported from the Keys).
Reynosia septentrionalis—Darling Plum. (Very beautiful).
Ocotea catesbyana—Lancewood. (Stands shade well).
Canella winteriana—(Magnolia-like foliage).
Schoepfia chrysophylloides—Whitewood. (Likes shade).
Zanthoxylum coriaceum—Hercules' clubs.
Zanthoxylum Clava-Herculis—Hercules' clubs.
Zanthoxylum flavum—Satinwood.
Zanthoxylum Fagara—Wild Lime.
Drypetes lateriflora — Guiana Plum. (Likes shade).
Drypetes diversifolia—Whitewood.
Gymanthes lucida—Crabwood. (Likes shade).
Enallagma latifolia—Black Calabash. (Stands shade. Wonderful foliage).
Eugenia axillaris — White Stopper. (Stands shade).
Calyptranthes pallens — Spicewood. (Stands shade).
Chrysobalanus pellocarpus—Tall Cocoplum.
Laurocerasus sphaerocarpa—West-Indian Laurel-cherry. (Demands shade. Very beautiful).
Amyris elemifera—Torchwood. (Stands shade).
Ilex Krugiana—Krug's Holly.*
Ilex Cassine—Dahoon Holly.*
Annona glabra—Pond-apple.*

Medium Shrubs:

Picramnia pentandra — Bitter-bush. (Likes shade).
Pithecolobium guadalupense — Monkey's Earrings.
Pithecolobium Unguis-cati—Monkey's Earrings.
Guaiacum sanctum—Lignum Vitae. (Stands shade. A dream when in bloom).
Eugenia rhombea—Stopper.
Anamomis dicrana—Naked Stopper.
Anamomis bahamensis—Bahama Stopper.
Calyptranthes Zuzygium—Myrtle of the River
Icacorea paniculata—Marlberry. (Stands full shade. Very fine).
Forestiera porulosa—Florida Privet.
Rapanea guianensis—
Hamelia patens—Redbush.
Erythrina arborea—Coral Bean.

Small Shrubs:

Tetrasygia bicolor—(Very fine when in bloom).
Byrsonima lucida—Locustberry.
Psychotria undata—Wild Coffees.†
Psychotria bahamensis—Wild Coffees.†
Randia aculeata—
Solanum bahamense—(Bird attraction).
Morinda Roioc—Yellow-root.
Callicarpa americana—French Mulberry. (Bird attraction).
Hypericum aspalathoides — St. John's-wort. (Very fine. Probably requires acid soil).

Ground-covers, Shrubby:

Chiococca pinetorum—Creeping Snowberry.
Rhacoma Crossopetalum—Ground-holly.
Geobalanus oblongifolius—Gopher-apples.
Goebalanus incanus—Gopher-apples.
Chionanthus pygmaea—Pygmy Fringe-tree.

(*Do well in swamp.)
(†Likes shade).

Ceanothus serpyllifolius—Thyme-leaved Jersey-tea.
Ceanothus microphyllus—Small-leaved Jersey-tea.
Dentoceras myriophylla—(Choice and rare).
(The last four probably require acid soil).

Vines:

Gouania lupuloides—Chowstick. (Stands shade).
Cissus sicyoides—Water Liana.
Echites Echites—Ramshorn Milkweed.
Exogonium microdactylum—Red Morning-glory.
Jacquemontia pentantha—(Very lovely).
Chiococca racemosa—Snowberry. (Likes shade).
Hippocratea volubilis—Monkey-vine.
Pisonia aculeata—Pull-and-haul-back. (Burglar-proof hedge).
Smilax Beyrichii—Sweet-briar. (Very fragrant).
Smilax spp.—Briars. (Blend well with Pisonia).
Lasiacis divaricata—Climbing Bamboo. (Likes shade.)

Ground-covers, Herbaceous:

Indigofera leptosepala—Creeping Wild Indigo.
Crotalaria pumila—Rattleboxes.
Crotalaria rotundifolia—Rattleboxes.
Dichondra carolinensis—(Likes moisture and some shade).
Peperomia obtusifolia—(Stands full shade).
Meibomia triflora—Tick-trefoil.

Perennials:

Asclepias tuberosa, A. decumbens—Milkweeds.
Asclepias humistrata, A. lanceolata—Milkweeds.
Asclepias Rolfsii—Milkweeds.
Aletris lutea, etc.,—Colic-roots.
Aster adnatus, A. squarrosus — Michaelmas-daisies.
Aster carolinianus, A. laevis — Michaelmas-daisies.
Amorpha herbacea, A. sp.—Leadworts.
Baptisia Leconti—False Indigoes.
Baptisia spp.—False Indigoes.
Bletia purpurea—Grass-pink.
Boltonia diffusa—Michaelmas-daisy.
Berlandiera subacaulis—Florida Dandelion.
Canna flaccida—Indian Shot.
Carduus pinetorum—Thistles.
Carduus spinosissimus—Thistles.
Chamaecrista brachiata—Partridge-pea. (Yellow sensitive-pea).
Commelina hamipila—Dew-flower.
Cracca spp.—Vetches.
Chrysopsis gigantea—Golden Asters.
Chrysopsis graminifolia—Golden Asters.
Crinum americanum—Swamp-lily.
Cuthbertia graminea—Pink Spiderwort.
Dichromena latifolia—Whitebracted Sedge.
Erythrina herbacea—Coral-bean.
Gerardia linifolia—
Helianthus elongatus—Sunflowers.
Helianthus undulatus—Sunflowers.
Helenium vernale—Sneezeworts.
Helenium tenuifolium—Sneezeworts.
Habenaria quinqueseta—Orchids.
Habenella Garberi—Orchids.
Heliotropium horizontale—Yellow Heliotropes
Heliotropium Leavenworthii — Yellow Heliotropes.
Hibiscus Moscheutos—Rosemallows.*
Hibiscus coccineau—Rosemallows.*
Hibiscus grandiflorus—Rosemallows.*
Hymenocallis humilis—Spider-lilies.
Hymenocallis Palmeri, H. rotata—Spider-lilies.
Ibidium cernuum—Ladies-tresses.
Indigofera caroliniana—Wild Indigoes.
Indigofera tinctoria—Wild Indigoes.
Iris hexagona—Sword-lilies.
Iris savannarum—Sword-lilies.
Iris versicolor, etc.—Sword-lilies.
Liatris gracilis—Blazing-stars. (Very fine).
Liatris tenuifolius—Blazing-stars. (Very fine).
Lilium catesbyi—Catesby's Lily. (Acid soil).
Limodorum pinetorum, L. Simpsonii, etc.,—Grass-pinks. (Lovely).
Lobelia glandulosa—
Lupinus diffusus—Lupines. (Acid sand).
Lupinus villosus—Lupines. (Acid sand).
Monarda punctata—Horsemint.
Nemastylis coelestina—
Pentstemon multiflorus—Beard-tongues.
Pentstemon australis—Beard-tongues.
Pentstemon lateriflorus—Beard-tongues.
Petalostemon Feayi—Prairie-clover.
Phlox amoena, P. Hertzii, P. floridana—
Pinguicula lutea—Butterworts. (Acid soil).
Pinguicula elatior—Butterworts. (Acid soil).

(*Tall and coarse, but showy).

Pychothymus rigidus—Pennyroyal. (Acid soil).
Piriquita tomentosa—
Polygala grandiflora, P. cumulicola—Milkworts.
Rhexia Alifanus, R. cubensis—Meadow-beauties.
Rhexia Nashii—Meadow-beauties.
Rudbeckia mollis, R. glabra—Black-eyed Susans.
Rudbeckia floridana, R. foliosa — Black-eyed Susans.
Ruellia humilis—
Ruellia ciliosa—
Ruellia parviflora—
Scutellaria arenicola—Scullcap.
Salvia coccinea—Sages.
Salvia lyrata, S. azurea—Sages.
Sisyrinchium graminoides, S. corymbosum — Blue-eyed grasses. (Lovely).
Sisyrinchium xerophyllum, S. longifolium — Blue-eyed grasses. (Lovely).
Solidaga Chapmanii—Goldenrods.
Solidago Leavenworthii—Goldenrods.
Solidago angustifolia, etc.—Goldenrods.
Sarracenia Drummondii—Pitcher-plants. (Acid soil).
Sarracenia flava—Pitcher-plants. (Acid soil).
Teucrium Nashii—Nash's Germander.
Tradescantia reflexa—Spiderwort.
Trilisa odoratissima—Southern Hound's tongues.
Trilisa paniculata—Southern Hound's tongues.
Viola spp.—Violets.
Vernonia altissima—Ironweeds.
Vernonia angustifolia—Ironweeds.
Vernonia Blodgetti—Ironweeds.
Viorna Baldwini—Pine-hyacinth. (Very fine).
Yucca filamentosa—Bear-grass.
Zephyranthes Atamosco—Fairy-lilies.*
Zephyranthes roseus (Cuban)—Fairy-lilies.*
Zephyranthes Simpsonii—Fairy-lilies.*

One more plant association exists in Tropic Florida. This is known as the "Scrub." It is more northern in character, and inhabits acid soil, such as we often find in dunes and "flatwoods" from the Miami city limits northward. To this association really belong some few acidophilous plants already mentioned. Among its outstanding representatives are the following:

(*As beautiful as Crocus).

3RD.—"SCRUB" ASSEMBLAGE

Trees:

Shrubs:

Pinus clausa—Scrub-pine.
Quercus myrtifolia—Scrub-oaks.
Quercus Chapmanii—Scrub-oaks.
Quercus pumila, etc—Scrub-oaks.
Bumelia tenax—Silver Buckthorn. (Very fine).
Ceratiola ericoides—Florida Rosemary. (Very fine).
Pieris nitida—Fetterbush.
Asimina obovata, A. spp.—Papaws.
Befaria racmeosa—Tarflower.
Garberia fruticosa—
Cerothamnus ceriferus—Dwarf Wax-myrtle.

Ground-covers, Shrubby:

Quercus minima—Pygmy Oak.
Gaylussacia dumosa—Gopher-berry.
Vaccinium nitidum—Huckleberries.
Vaccinium myrsinitis—Huckleberries. (Very beautiful).

Most of the Beach species also succeed farther inland, so we simply add them to our Hammock assemblage. It is different with the "Scrub" species. Very few, if any, of these will adapt themselves to alkaline soil, while quite a few of the Hammock species will adapt themselves to acid soil. Much work will be required before we are able to state definitely what each species will do on each type of soil.

One thing however, is certain: This list of mostly new material, added to the pick of what is already commercially obtainable, would give us such a range in both color and texture—such a gamut of chords, such a variety of scales to choose from for our compositions—as probably no other region could produce. Where, for instance, could we find such a natural Beach assemblage as this: A sea of lavender Beach-verbena, flecked with fragrant, golden Lantana, splashed with radiant pools of Beach-sunflower, spotted with islands of Seaside Purslane, veined with Goatsfoot Morning-glory, and jaspe with creeping Crotalaria. Into this sea jut jagged cliffs of dull-green Bay-cedar, fantastic wave-sculptured capes of horizon-gray Beach-heliotrope, smooth, undulating coasts of dark-green

Beach-cocoplum, and ragged headlands of Blue Dune-grass, backed by a mountain-range of dense, massive Buttonwoods, against which the snow-white bloom of a group of large Spanish Bayonets resembles nothing as much as a flock of dazzling glaciers. Where else could we find such an assemblage ready at hand, growing wild, just where it is wanted? Yet how many such pictures have not been ruthlessly wiped out with mattock and fire? Why are the majority of our "developers" so blind to beauty that we replace the second e in their title with an i?

With such a treasure-trove of choice material to draw on, it is hard to explain the remarkable poverty of our nurseries, and the consequent tawdry sameness of the general run of our gardens. I have here named more than one hundred species of indigenous herbaceous perennials, yet who has ever seen a fair perennial border in Tropic Florida? True, a few of these plants require acid soil, and as a rule they are not quite as easy to grow as acalyphas and crotons; but were only fifty per cent of the enumerated species available, by adding these to the best material now in use we should be able to landscape attractively, permanently, and economically, every beach, every subdivision, every airport, every school, every street, and every home—not to mention every park, and every play-ground—in Tropic Florida.

Could we then also manage to get rid of those cigarette and match-scattering morons, who are responsible for nearly all of the fires that make our wild lands look like charcoal-yards, what a country this would be to live in.

THE CULTURE OF TERRESTRIAL ORCHIDS

T. A. Fennell, Homestead

The subject of my talk, orchids, covers so large a field that I must, of necessity, select some division of the family for my discussion tonight. Therefore, I will discuss briefly some of the most promising terrestial or ground orchids that can be grown in South Florida Gardens.

Ground orchids possess one great advantage over their brothers the epiphytic or tree orchids as they are as a rule easily grown by ordinary cultural methods. Their requirements vary with the species but as a group they are no more particular than are lilies, amaryllis or many other commonly grown garden plants. In general they like a rich, open, well drained soil and plenty of moisture.

Some of the most beautiful and showy of all the orchids belong in this group. We have grown successfully here several species each of the following genera: Phaius, Cymbidium, Cypripedium, Selenipedium, Calanthe, Spathoglottis, Bletia, Lissochilus, Arundina, Peristeria, and Sobralia.

The beautiful species of Phaius are tall, handsome plants with dark green plicate leaves and stately spikes of large, attractive flowers. Nearly all of the twenty species make themselves thoroughly at home here. They are easily grown and reasonably priced, though rather scarce at present. Phaius tankervilleae (P. Grandifolius) is the best known species and is altogether a very charming garden plant. The sepals and petals are dark bronze in color on the front and light gray on their backs while the lip is deep purple. The flowers are from three to four inches in diameter and are borne, twelve to fifty of them, on erect spikes sometimes as much as four feet tall.

Then the Cymbidiums—probably the best of all the terrestial orchids. Their numerous species and hybrids offer a wonderful selection of flower size, color and form. They are obtainable in colors from light green through the yellows and browns to white and rose. The blossoms are usually large, very graceful and generally borne on tall, arching, multiflowered spikes. They are shade lovers and delight in plenty of moisture at all times but must not be allowed to become water logged. Literally thousands of fine hybrids of this genus have been developed during the past years and though the plants are expensive they will be found to be a very distinct addition to any fine garden.

The Cypripediums or Lady Slipper orchids present another very large and interesting genus of shade and moisture loving ground orchids. Most of us are familiar with their distant relatives the pink and yellow Lady Slippers of the northern swamps.

The tropical Cypripediums belong to the genus Paphiopedilum and are not closely enough related to the northern forms belonging to the genus Cypripedium to allow cross breeding. Paphiopedilum, though it is botanically the correct name of all the tropical East Indian cypripediums, is not used generally by horticulturists as most of them prefer the simpler name Cypripedium for all common use. When I refer to Cypripedium in the following paragraphs I will, therefore, have in mind the tropical section of these plants.

Cypripediums have been used to great advantage by the hybridists. In fact, the newer, more advanced hybrids are so much better than the species in both form and color that they are rapidly replacing the species in cultivation. Cypripediums are of comparatively easy culture and there are thousands of species and hybrids from which to choose.

Selenipedium, or botanically Phragmopedilum, is another genus related to the Lady Slippers. This genus is of South and Central American origin while the Cypripediums are native to the East Indies.

Selenipediums have very odd and beautiful flowers—some of them with twisted, ribbon-like petals as much as eighteen inches long. The flowers have the pounch-like lip characteristic of the whole Cypripedium tribe and are found in a great range of beautiful colors from green through white, yellow and brown to rose. The flowers are borne, several to the spike, on long erect stems. Their culture is easy and they are perhaps better adapted to our climate than are the East Indian species as they delight in plenty of moisture and warm humid atmosphere. The Cypripediums, on the other hand, do not like the weather when it becomes very warm.

The genus Calanthe also contains hundreds of hybrids and species of beautiful and interesting orchids. They are closely allied to Phaius and numerous bi-generic hybrids of great beauty between species of these genera have been obtained. The genus Calanthe is divided in two sections, one of which contains the decidious and the other the evergreen species.

The decidious Calanthes have more showy flowers than do the evergreen ones and are those most generally seen. They are of very easy culture and can be grown as ordinary bulbous plants. Their flowers are very attractive, borne on tall arching spikes and usually white, white and crimson or rose.

Then there are the Spathoglottis allied to the Calanthes and Phaius, that have beautiful flowers of violet, white, pink or yellow; the Lissochilus, an African genus one species of which has flower spikes as much as sixteen feet tall; the Bletias, one of which is native to South Florida and many, many others.

In this short resume of the principal ground orchids I have tried to outline the groups that I think offer the most promise of beautiful, unusual, and extremely satisfactory flowers for our gardens. From these genera one can select species and hybrids to fit any pocketbook, any tropical cultural conditions or color scheme.

None of these plants is common in our Florida gardens due chiefly, I believe, to the fact that most of us seem to think that because they are orchids they are difficult, if not impossible, to grow. This idea has no foundation in fact when it is applied to mature plants. Ground orchids, are, however, just as difficult to grow from seed as are the epiphytes.

For those of us who want something beautiful and different these plants present opportunities to beautify the garden and patio with an exotic and tropical touch most appropriate to Florida. When raised in pots they afford beautiful and unusual porch or house plants.

It has been said time after time that orchids and particularly ground orchids, cannot be grown in Florida successfully. In answer to this I can only say that they are growing, they are growing well and they have been growing well for several years.

I believe that more species of orchids can be grown successfully outdoors in South Florida than can be grown in greenhouses in any other one section of the United States. I am firmly convinced that Florida offers a very nearly ideal climate for most tropical orchids.

FLORIDA NATIVE PLANTS AND THEIR USE IN LANDSCAPE WORK

By Roger S. Nason, Sebring, Florida.

For quite some years in the North there has been an increasing interest in naturalistic landscape gardening. The use of native flora in combination with cultivated subjects, construction of wild gardens, bog gardens, etc., and in the preservation and care of wild growth on numerous parks and private estates throughout the country.

Seemingly Florida has been rather late in awakening to the fact that we have as great a number of useful native shrubs and trees as in any other locality of the country. Our Department of Agriculture, and private interests have for many years contributed great efforts toward introducing ornamentals from all four corners of the globe and yet our native flora has received but scant attention when it comes to methods of handling and information on useful types.

Generally all of our native materials are frost resistant except those types that grow on our coastal regions and southern Keys.

As there are practically no firms offering any variety of collected material, it is necessary to make one's own individual collections. It should be kept in mind, however, that it is indeed well to secure permission from the land owners before any material is secured.

Much of the success in transplanting lies in the method employed in digging, transporting and planting the material out of the woods. The writer has successfully moved material twelve months in the year, but during the winter months is usually acceded to be the best season. Quite often one is able to find the material desired growing in quite close proximity to his holdings. Unless it is growing on heavy soil it is practically useless to attempt digging as nearly all types should be dug with a good sized ball or block of earth attached to the roots. Usually such locations have a good heavy growth of what is called "cut throat grass." This makes an admirable turf and also holds the block of earth more intact around the clump of plants. One is warranteed in making extensive surveys throughout any locality until the plants growing under the proper conditions are found. It should also be understood that subjects desired must be located where they are growing in groups not mixed with other types of plants such as palmettoes or pine or oak saplings whose roots will prevent the digging of solid blocks of earth.

Soil conditions in the planting area need not be of the same type as that found in the locality of collections as nearly all of our swamp subjects will thrive on the sandiest of our soils even in the Ridge section by using irrigation and fertilizers. The writer has used as high as 150 yards of pulverized muck to the acre broadcast and well dug in. However, very good results have been obtained where there have been no additions of bulky humus to the soil otherwise than what has been made by the applications of organic fertilizers such as Tankage, Peruvian Guano or Castor Pomace several times yearly after the plantings become established.

Usually when the plants are moved with blocks of earth it is unnecessary to do but little pruning, thereby securing quite good immediate effects. Even in bare-root subjects it is not always well to prune back too severely though the defoliation should be very thorough. Many times when material has been pruned back to real hard wood it is reluctant to sprout whereas if defoliated half-ripe wood has been left, the sprouts usually follow in a few weeks.

In planting it is very essential that plants be set very firmly, large quantities of water used and frequent watering be made for five to six months thereafter, whenever dry weather sets in.

In general, there are no set rules regarding the design or arrangement of the plants. The way Nature has arranged them should be a great lesson, but the best knowledge must necessarily come from the actual experience of handling

such work. Foundation effects, massings, screens, woodland treatments, wild gardens, water gardens, etc., can all be carried out in the Naturalistic scheme. Lawn areas can be considered or ground cover subjects, whichever the occasion demands.

The three most commonly used native shrubs in use in the landscape work throughout the State are the Wax Myrtle (Myrica Cerifera), Saltbush (Bacharis Halmifolia) and Gallberry (Ilex Glabra). Another subject in habit of growth resembling the Gallberry is the Tar Weed (Befaria Racemosa). With its grayish green leaves and sticky white flowers borne in early summer, it makes a good contrast and relief of monotony when mixed throughout massings. The Fetterbush (Pieris Nitida) is also a very valuable subject. It is a winter bloomer and can be obtained in large sizeable clumps. A plant known in some sections of the State as "Nigger's Ears" (Xolisma Ferruginea) is quite often the host for a very odd and interesting fungus that aborts the leaves and flowers into very fantastic shapes and colorings—though apparently doing no harm to the growth of the plant in any way.

Interspersed between shrubs of a medium growing height it is well to scatter material of rather a dwarfer nature, such as Dwarf Wax Myrtle, (Cerothamnus Pumilis); Comptie, (Zamia Integrifolia and Floridiana); Swamp Lily, (Crinum Americanum) and (Hymenocallis Caribaea); Tiger Lily, (Lilium Catesbaei); Bear's Grass, (Yucca Filamentosa); Creeping Sunflower, (Wigelia Sp.); Yellow Jasmine, (Gelsemium Sempervirens); Sea Morning Glory, (Ipomoea Pescarprae); Rouge Plant, (Rivinia Humilis); Milk Weed, (Asclepias Tuberosa); Wild Poinsettia, (Euphorbia Heterophylla); Scarlet Bush, (Hamelia Patens); Sweet Flagg, (Iris Versicolor); Hog Plum, (Ximenia Americana); and the Cherokee Bean (Erythrina Herbacia).

The St. John's Wort family lend themselves very nicely to the planter in that they do not seemingly mind transplanting in the least, and while they may be collected in locations where they may be anywhere from two to six inches deep in water, they never even stop blooming when moved into the higher soils. Three types are especially valuable, namely St. John's Wort, (Hypericum Aspalathoides); and the St. Peter's Worts (Ascyrum Tetrapetalum and Hypericoides).

There are many other worthwhile subjects of medium height ranging from three to ten feet that can be used. For instance:—the Snowball, (Viburnum Abovatum); Possum Haw, (Viburnum Nudum); Black Haws, (Bumelia Angustifolia and Lanuginosa); Marlberry, (Icacorea Paniculata); Wild Olive, (Osmanthus Floridiensis); Limeberry, (Zanthoxylum Fagara); Beautyberry, (Callicarpa Americana); Wild Coffee, (Pyschotria Undata); Rattan Vine, (Sageretia Minutiflora); Fringe Tree, (Chianothus Virginicus); the Scrub Oaks, (Quercus Geminata and Myrtifolia) and (Ceratiola Ericoides) (Ilex Decidua) (Rapanea Guineenis) and Dodonea (Dodonea Viscosa).

Our coastal regions, islands and Keys represent an almost endless collection field but it must be remembered that a great percentage of the material is not very frost resistant in interior Florida except in quite frost-free locations. The writer has handled the following types of plants: Spanish Bayonet, (Yucca Aloifolia); Sea Grape, (Coccolobus Uvifera); Pigeon Plum, (Coccolobus Laurifolia); Coco Plum, (Chrysobalanus Icaco); Stoppers, (Eugenia Buxifolia and Axillaris); Spice Tree, (Anomomis Dichotoma) (Sophora Tomentosa); Satinwood, (Chrysophyllum Monopyrenum); Mastic, (Sideroxylon Mastichodendron); and then the Cactus and succulents such as: Cephalocereus Keyensis, Cereus Deeringei, Harrissia Brooki, Arboriginum and Simpsonia, Agave Decipens and Americana, Acanthocereus Pentagonus, and the various Opuntias or Prickly Pears.

The writer has only touched briefly on the different types of shrubs that can be handled and time and experimentation will bring a multitude of worthy subjects to light.

It is not necessary to confine all plantings to shrubs and vines as there are quite a few trees that are useful such as the Loblolly Bay, (Gordonia Lasianthus); White Bay, (Magnolia Gluaca); and members of the Avocado family (Persea Borbonia and Humilis). All of these can be transplanted with large blocks of earth attached, which will insure the life of nearly 100

per cent. Our smooth-leaved Holly, (Ilex Dahoon) is probably one of the easiest trees of shrubs to succeed with. Usually size is no barrier in moving. Collected during the winter months one can very easily pick the berried specimens, as a large number of them are nonbearing and the birds, especially the robins, are fond of the fruit in late winter. Therefore, the trees should be marked early in the season.

In our high, sandy soils we can succeed admirably well with the collected Cherry Laurel, (Laurocerasus Caroliana); also the Live Oak, (Quercus Virginiana); which can be moved as large as the size your equipment will handle. While not quite so easy to handle, the Magnolia Grandiflora certainly should be planted. The Pond Pine, (Pinus Serotina) can quite often be moved safely if a large block of turf is cut with the plant. They usually can be handled up to about six feet high. Where the tap root has made a deep growth it is usually futile to try to dig but where the tap root has not yet developed, one can usually cut a good sized block in heavy soils.

The Cabbage Palm, (Sabal Palmetto) certainly should not be left out for it is a keynote or real framing for the tropical picture. Used in groups or islands on large properties, as accent subjects in certain foundation locations, or as background subjects, they are fine. What is better than to combine them in informal massing with the Needle Palm (Rhapidophyllum Hystrix), Saw Palmetto (Serenoa Serrulata) and also the glaucous type found on the coast. If the location be frost free, by all means introduce some of the Silver Thatch Palms of our extremeities (Thrinax, Keyensis,) and other types. It should be borne in mind that large specimens in the Palm group move better than the small seedling specimens. In such groupings one should introduce some climbers for the tall Cabbage Palms such as the Yellow Jasmine, (Gelsemium Sempervirens); Red Honeysuckle, (Lonicera Sempervirens); Virginia Creeper, (Ampelopsis Quinquefolia); Bamboo or Pipe Briar, (Smilax Laurifolia). If the groupings are in close proximity to the waters' edge, by all means plant the wild Tree Fern (Acrostichum Vulgare); the Mallow family (Hibiscus), the Pitcher Plants (Sarracenias); Arrowheads (Sagittarias); Sweetflagg (Iris Versicolor); Lizard's Tail (Saururus Cernus) and Arums (Peltandras).

It is not the idea of the writer to convey a radical, back-to-Nature movement in the use or selection of landscape materials and principles and completely ignore those many worthy horticultural subjects that have been in usage for some time. It is simply to call attention to the many useful native subjects that can be handled quite successfully from the woods and swamps throughout the State, and that when used separately or in conjunction with other material, will add a substantial element to the Florida landscape scheme.

THE CHAYOTE—ONE OF FLORIDA'S UNDEVELOPED RESOURCES

By Gordon M. Dickinson and Florence E. Cain, DeLand, Fla.

The Florida grower looking for a crop which will yield a maximum return for a minimum of effort will be interested in the results of experimenting with a vegetable recently introduced to the purchasing public and which has received much publicity this past year through magazines of general circulation. Here is a vegetable peculiarly adapted to Florida climate and soil, which produces profusely and perennially, which requires relatively little care, and which matures at the time of year when other vegetables are scarce.

In the February issue of Better Homes and Gardens, Mr. R. A. Young of the United States Department of Agriculture has an article entitled "Chayote—a New Vegetable from the Tropics." While the chayote is comparatively new in the United States, it is by no means a new development in the vegetable kingdom. It has an ancient and honorable history which dates back to pre-Maya times. A native of Guatemala, it was

brought into this country from Mexico and has for several years been raised in small quantities in Florida, Louisiana, southern California, and to a very small extent in some other southern states, being known by various names, trellis squash, mango squash, vegetable pear, mirliton, but the Mexican name of Chayote is the one in most general use. Although the Department of Agriculture has for some years been encouraging the raising of this vegetable and has spent over $20,000 upon its introduction, the chayote has thus far been raised mostly for home consumption, being marketed only in small quantities. The first car load ever shipped out of Florida was sold in a northern market in the fall of 1929.

The chayote may be successfully raised anywhere in the south where the ground will not freeze. The soil should be rich, well-drained loam which will maintain a fairly uniform moisture content at all times. When raised in muck land, it bears profusely but the fruit is so tender that it lacks keeping qualities. Experience therefore shows that muck land is satisfactory for raising chayotes for home consumption but not for shipping. In light sandy soil the vines should be heavily mulched and watered at least once a week to prevent burning out during dry weather. Organic fertilizers are best adapted to the use of the chayote and a liberal amount should be mixed with the soil at the time of planting.

The proper time for planting the chayote in Florida, under normal weather conditions, is about the first of March. The whole fruit is planted, and it is well to have it well sprouted before planting. However, if it is left to sprout on the vines, it should be planted soon after picking. The fruit is placed in the ground at an angle of about forty-five degrees, with the blossom end down, the fruit being barely covered with the soil, or with the small or stem end projecting slightly above the surface. Four hundred to eight hundred plants are required per acre, depending upon the drainage conditions and quality of the soil. They are planted one to a hill. They should not be cultivated except merely to keep the grass mowed down.

As the plant is a climbing vine, it requires a trellis. A good trellis for the purpose is built like an old fashioned grape arbor and covered with chicken wire, although a fence, a building, or even a tree will serve if there is not too much shade. Chayotes have been raised in connection with ferneries, but the vines are apt to produce too much shade for the fern, and further, any pests which attack the chayotes would be apt to damage the fern. For these reasons the plan of raising ferns and chayotes together is not considered the most practical. While most of the fruit hangs and matures underneath the trellis, some means of harvesting from the outside should also be considered when the trellis is constructed.

The chayote bears twice a year, the larger crop being in October and November and a smaller crop in May and June. Under favorable conditions the vines may bear a spring crop the first year. The plant is perennial. After the fall crop the vines die down and new sprouts grow from the roots. One plant eleven years old is known to be still bearing. The vines grow to a length of thiry to sixty feet and bear an average of 150 to 250 pounds, though a single vine has been known to bear 600 pounds.

Chayotes are of several varieties, the fruit ranging in color from ivory to dark green and in weight from two or three ounces to two or three pounds, according to variety. The skin is smooth except in some inferior varieties which bear a few spines. It is somewhat pear-shaped and has one large seed which is also edible. The flavor of the chayote is delicate and has been likened to that of roasted oysters, sweet potatoes, chestnuts, or vegetable marrow. Because of its easy digestibiliy and its mineral content, it is valuable in the diet, and has been recommended by physicians for use in hospitals. One of its distinctive characteristics is the fact that the flesh, though tender, is firm enough to hold its form when cooked.

As to it uses, the chayote is the most versatile of vegetables. It may be prepared by many tempting recipes: buttered, creamed, fried, baked, pickled, in fritters, as a raw ingredient in salads, and even in a dessert. The tender tips may be used as greens, somewhat resembling asparagus tips, the mature foliage is sometimes used as fodder for cattle and as fresh greens for chickens, excellent honey is produced from the flowers, while in Mexico the tubrous roots are used like

potatoes, and straw from the vines is utilized in making hats and baskets.

A satisfactory method of packing the chayotes for shipping to northern markets is as follows: The fruits are wrapped individually in waxed paper and are packed in crates of about forty pounds to a crate. The writer also encloses with each fruit a circular giving recipes for its preparation. This method is somewhat expensive, but is an aid to the wholesaler who is trying to introduce the vegetable, and after it has been thoroughly introduced, the expense may be lessened.

Its keeping qualities are another of the chayote's assets. In warm weather, under ordinary store conditions, and if harvested just before its full maturity, it will keep for six or eight weeks, and in a temperature of forty-five to fifty-five degrees, it will keep for six months. It also stands shipping well. When properly packed, it is not affected by a ten-day journey. These facts make it a most satisfactory vegetable for selling in distant markets, and the fact that its larger crop matures at a time when other fresh vegetables are scarce gives it an additional advantage.

Now for the other side of the ledger. The chayote, like other vegetables, has its enemies. The pests to which it is subject are the same as those which attack cucumbers, squashes, and melons and they are combatted by the same methods. A nicotine spray is used for worms and aphids, and arsenate of lead for leaf-eating insects.

As to market value, the chayote has not as yet become a profitable crop for the reason that it has not heretofore been raised in commercial quantities. It has been sold in small lots in the east and middle west. The first car load ever shipped out of Florida was shipped from Volusia County in the fall of 1929 at a total loss. In the fall of 1930 the writer was instrumental in marketing about 20,000 pounds in eastern and middle western markets, which resulted in a small profit. However, the many inquiries which he is receiving from all parts of the country indicate a rapidly growing interest in the chayote, and with the wide publicity which it has received during the past year, the efficient work of the Department of Agriculture, and the efforts of the pioneers who are willing to take the losses incident to the introduction of any novelty, we believe that within a year or two the chayote should prove to be a highly profitable crop for the Florida grower.

This writer of this paper is not an agriculturist, being by profession a public accountant, but he is a Florida Cracker and as such is interested in the development of the state's agricultural resources, and should be more than happy to co-operate in any possible way in any effort at organized marketing of the chayote, which is undoubtedly one of Florida's future assets.

THE GROWING OF PINEAPPLES ON THE LOWER EAST COAST

R. A. Carlton, West Palm Beach, Fla.

Many reasons have been advanced in explanation of the decline of the pineapple industry, which in 1910 utilized more than 5,000 acres of land and yielded more than a million crates of fruit, ranking second only to citrus fruit in horticultural importance to Florida. These reasons included the lack of a protective tariff, unfavorable weather conditions, high labor costs, scarcity of desirable slips, prevalence of red wilt, inferior fertilizers and scarcity and high price of suitable lands.

First, let me call attention to several economic factors which I hope will establish in your minds pertinent reasons why concerted effort should be applied to restore the industry to its former importance and the important position it fills in the horticulture of the lower east coast. This enterprise does not compete with other crops for land. The St. Lucie sands extending along the coast roughly from Vero Beach to New River, have little agricultural value except for pineapple production. Undoubtedly, the rapid increase in the

value of these lands, climaxed by the boom, abetted the decline of the pineapple industry. The valuation of these lands today certainly justifies their utilization for the growing of pines.

Before leaving the subject of land, let me say that I have observed considerable variation in the acid reaction of different areas of St. Lucie sand, which probably accounts in a large measure for the unthrifty growth exhibited by some plantings in the later days of the industry. Reports from Hawaii state that a PH between 4.5 and 6.5 promotes growth of pineapples, while a PH above 6.5 inhibits their growth. I have recently tested undeveloped St. Lucie sands running a PH above 6.5, while nearby areas indicated a PH slightly above 4.0. Tests made in abandoned fields where plantings had succumbed to wilt, indicated a neutral soil condition. I offer this as a suggestion that might be important in accounting for some of our problems in the past and should be considered in selecting a site for a pineapple planting.

Pineapple growing does not compete with established enterprises for labor. When excess labor is required for harvesting in late May, June and July, the vegetable and citrus industries have many idle laborers. Then in July, August and September, when new land is prepared and new plantings established, the same condition exists.

Pineapple plantings may be rapidly expanded. This is especially true of the commercial variety, Red Spanish, because of its tendency to produce a large crop of slips. This is also true with the Abachi, which under the present state of affairs might prove our best commercial variety, because of its larger size, later maturity and excellent dessert quality. The fact that it matures a full month later than Red Spanish will allow the West Indian competition to clear off the market, and as the sizes run to a majority of 18's and 24's, they are received better by the trade. The objection to this variety in the early days was its tenderness and tendency to decay in transit. I believe with faster freight movement of today and more careful handling, this objection might be overcome. The Smooth Cayenne variety is propogated chiefly from suckers which precludes the possibility of rapid expansion of plantings. Its tenderness and tendency to sunburn prevent it from becoming extensively grown, except for the fancy fruit trade.

Although our best commercial varieties produce an abundance of slips and plantings may be rapidly expanded, it is essential that the greatest care be exercised in the selection of new planting stock. It has been found that large slips and suckers selected from healthy vigorous plants not only produce much stronger plants, but they are more free from disease. Furthermore, they come into bearing twelve to twenty-four months sooner than weak or diseased plants. In every case, best results are obtained where material is selected with the greatest care from the strongest, healthiest and most productive parent plants. Cuba was once a source of new planting stock because of the impression that longer productivity was secured on slips from this source. This reputed superiority was due solely to the fact that they were larger and were usually taken from strong, vigorous plants. Home grown slips give similar results where selected from equally desirable plants. Porto Rico is now the sole source of West Indian slips for Florida growers, because of the Cuban embargo against the exportation of slips to competitive producing areas. Vigorous selection has been practiced there and high production secured as a result.

The pineapple crop is little affected by extremes of flood or drought. The soil on which they are grown maintains a fairly even moisture condition, despite unusual weather conditions. Neither is it affected by windstorms. Any horticulturist on the lower east coast can appreciate the importance of this factor.

Pineapple growing does not involve the purchase of expensive equipment, or require intensive supervision. After a planting is established, the scuffle hoe used in cultivation, comprises the sole outlay for equipment, although during harvesting a wheelbarrow is used to move the fruit out of the field. Therefore, no high overhead can be charged for interest and depreciation on equipment. The item of supervision, aside from the harvesting period, embraces the broadcasting of three applications of fertilizer a year and from three to five hoeings depending upon the age of the planting. It is generally conceded that pine-

apple growing lends itself better to absentee management than any other crop.

Pineapples are not affected in Florida by any serious insect pest or grave disease problem. The statement with respect to disease problems is made advisedly, inasmuch as red wilt, generally conceded a disease, occasioned by attacks of nematodes, was credited with causing the decline of the industry. It is true red wilt caused grave concern for a time, but the Bureau of Plant Industry demonstrated that this problem could be solved economically by proper soil management, resulting in replenishment of the soil's humus content. Details of this work are contained in Farmers Bulletin 1237. These experiments were conducted prior to the introduction of crotalaria, and if natal grass, which was the cover crop used in these experiments, gave any degree of promise in combating wilt, may we not expect miracles from crotalaria. Porto Rico is now raising this legume to marked advantage in maintaining high production on old fields. Heavy crops are secured following this crop where pines have been grown for twenty-five years.

Florida plantings made on desirable soils and with carefully selected slips, produce profitable crops for a long period of years. In fact, I believe Florida may well claim the world's record for continuous production from a single planting. Fields at Delray Beach are now in their sixteenth year and are still producing satisfactory returns. When such a record is compared with two crops in Porto Rico and three to four crops in Cuba, considerable encouragement may be obtained for reviving the industry in Florida. This condition of longer productivity in Florida may be due to the planting system, soil character, or climatic differences. A discussion of these differences would involve too long an explanation at this time.

Cost of production is an important item to consider in the growing of any crop. In an effort to develop definite data on the cost of production of pineapples on the lower east coast, the speaker made a survey among twenty growers between Stuart and Boca Raton and secured their figures and estimates on the various items of cost from the clearing and preparation of land to loading in the car. The survey was made to cover a six and one-half year period, which allows for the harvesting of five crops. The average cost loaded in the cars, including taxes and interest charges for the twenty growers, was $1.40 per crate. The average yield per crop for a five crop period as developed in this survey was 234 crates per acre. During the eleven-year period from 1917-27 the average net return to the growers at Delray and Boynton, after selling costs were deducted, was $3.08 per crate. When the $1.40 production cost is deducted, a net return of $1.68 per crate is left. This net return figured on an average yield of 234 crates per acre gave an average net profit per acre of $393.12.

Next, let us consider the cost of production in the West Indies. The Porto Rico Fruit Exchange reports a cost of production of $1.87 per crate along shipside in San Juan, or a cost of $2.67 per crate delivered in New York.

In hearings before a sub-committee of the Committee on Finance, U. S. Senate, the Porto Rican interests presented a brief showing the cost of production in Cuba, loaded on the cars, as $1.0775 per crate. The Cuban interests in refutation filed a brief claiming an F. O. B. cost of $1.4507 per crate or a delivered cost at the average consuming center of $3.222 per crate. Admitting that both interests might have been over zealous in the preparation of their figures and averaging the two production costs, the result is a charge of $1.264 for Cuban pines loaded on the cars. This indicates a differential of approximately fourteen cents a crate in favor of Cuban pines over Florida. However, when the present tariff schedule of forty cents per crate is applied, there is a differential of twenty-six cents per crate in favor of Florida. These figures are given in an effort to show the position of the Florida grower with respect to competing areas.

In conclusion, let me again call attention to the place the pineapple industry fills in the horticulture of the lower east coast, with respect to the utilization of land and labor. Also its relative freedom from damage by the common hazards and the parity in production costs with competing areas makes the possibilities for restoring this enterprise quite encouraging. It is believed that the most important problems causing its decline

have been or may be successfully corrected. However, pineapple growing is no exception to the rule that careful, preliminary investigation, skill and the application of business principles, are as essential to success as in any other fruit growing enterprise.

ITEMIZED COST STATEMENT OF PINEAPPLE PRODUCTION ON THE LOWER EAST COAST OF FLORIDA

Prepared By R. A. Carlton, Agricultural Agent, S. A. L. Ry., West Palm Beach, Fla.

J. N. McBride, General Agricultural and Land Settlement Agt., S. A. L. Ry.

This statement is based upon reports made by twenty growers in the Stuart, Boynton and Delray sections. The general practice is to harvest the first crop eighteen to twenty months after planting and annually thereafter as long as the plantation produces profitably. Plantings made in the earlier days of the industry on virgin soil bore profitably for ten years or longer, and the concensus of opinion among growers interviewed for this report was that planting made with vigorous West Indian slips, on virgin land, would always produce eight or ten profitable crops. However, in view of the increasing prevalence of disease in more recent years, the calculations in this report are based upon the production of five crops, which will cover a period of five and one-half years. The average yield per acre for five crops for the twenty growers interviewed in this report was 234 crates. A yield of 175 to 200 crates per acre was expected after the fifth crop, if the plantation remained productive.

ANALYSIS OF THE FIGURES IN THE TABLE

Clearing and preparation of land includes grubbing, burning brush, raking off trash, leveling and marking off ready for setting. Approximately seventy-five per cent of the expense is for grubbing and burning brush and balance for the items of raking, leveling and marking off. Grubbing is usually done on the basis of a task which is fifty feet square with eighteen composing an acre. The cost of grubbing a task varies from two to five dollars.

All growers signified a preference for West Indian slips to insure prolonged production. Calculations in this report are made on the basis of 10,000 slips to an acre. The number per acre varied among growers from 8,500 to 12,000. The amount indicated in the table represents purchase price, packing and freight charges to destination. Some growers reported having paid from $20.00 to $25.00 per thousand for Cuban slips and considered them well worth that amount.

The cost of stripping and setting differs widely, ranging from one to four dollars per thousand. The average cost being $2.19 per thousand. Some growers did not prefer to trim the slips which reduced the cost of this operation about one-half.

The fertilizer cost differs widely according to the personal opinion of the grower. All growers reported the practice of "budding' young plants with cotton seed meal or castor pomace which prevents sand from blowing in and smothering the bud. The amount of material used for budding varied from 100 to 1,000 pounds, the average being 423 pounds. The grower reporting the application of 1,000 pounds used tankage and combined budding with his first general application. The amount of fertilizer per acre necessary to mature the first crop ranged from 4,000 to 7,400 pounds. The average being 5,483 pounds. The annual application after the first crops varied from 3,500 to 5,500 pounds, the average being 4,280 pounds. Most growers preferred to make three applications a year.

Calculations on the cost of fertilizer, including freight, in this report was based on $45.00 per ton for cotton seed meal; $40.00 per ton for Castor pomace, and $50.00 per ton for all complete fertilizers, tankage, dried blood and blood and bone tankage. The expense of hauling and ap-

ITEMIZED STATEMENT OF COST PER ACRE

(For establishing plantation on virgin land—Maintaining and harvesting five crops)

	Highest	Lowest	Average
Clearing and preparation of land	$160.00	$ 50.00	$ 92.71
Cost of West Indian slips	250.00	50.00	117.45
Stripping and setting	40.00	10.00	21.93
	$450.00	$110.00	$232.09
Average cost per crop	90.00	22.00	42.42
Fertilizer	140.70	90.62	115.17
Hauling and applying fertilizer	7.16	4.50	5.79
Hoeing	56.00	6.40	17.76
Picking	30.00	7.50	16.23
Packing	51.00	12.50	23.92
Containers	84.00	44.10	64.92
Hauling	30.00	2.70	10.09
Car strips and loading	6.00	2.10	3.46
Taxes	6.00	2.00	3.15
Interest on capital invested in land	17.60	4.40	8.08
Interest on initial costs and maintenance	19.52	10.30	13.61
	$537.98	$209.12	$328.60
Average yield per acre	300 crts.	180 crts.	234 crts.
Average cost per crate	$ 1.69	$ 1.20	$ 1.40
	$421.94	$204.22	$255.88
Average yield per acre after 1st crop	312 crts.	150 crts.	220 crts.
Average cost per crate after 1st crop	$ 1.44	$ .88	$ 1.18

plying fertilizer is figured at the rate of $2.50 per ton.

Great difference of opinion occurred on the item of hoeing. Some growers virtually discontinued hoeing after the third crop. However, the majority favored hoeing after each application of fertilizer. One grower reported the use of a wheel hoe in working young plants which materially reduced his hoeing cost. The lowest annual report on this item was $6.40 an acre. The highest $56.00 and the average was $17.76. This represents an approximate cost of seven and one-half cents per crate.

The cost of picking includes the labor involved in breaking the fruit off the plants, loading in field boxes, wheeling to roadway and loading ready for hauling to packing house. The approximate cost per crate for this operation is seven cents.

The packing operation includes the cost of paper, sizing, packing and nailing up the crates. The average cost per crate was ten cents.

Cost of containers also includes the cost of nails and labor for making, which varied from one to two cents each. The cost of crates ranged from twenty-four to twenty-six cents each. The majority of growers reporting a cost of twenty-six cents.

The hauling charges cover both the hauling from field to packing house and from packing house to car. The average cost per crate for this item was 4.3 cents.

Car strips were figured on the basis of $20.00 per thousand and the use of seventy-five strips to a car. The balance of this item was for labor in placing crates in car and stripping and was calculated at the rate of $2.00 a car.

Taxes varied from $2.00 to $6.00 an acre. The average being $3.15 per acre. The high tax rate in most instances was due to the extensive municipal incorporation in the sections surveyed.

Growers interviewed relative to what price they would pay for land suitable for pineapple growing, and an annual interest of eight per cent was figured on amount given to derive the interest on capital invested in land. The highest amount any grower indicated he was willing to pay for land was $200.00 an acre. The lowest was $50.00 and the average for the twenty growers was $93.00 an acre. These prices represent only unimproved land.

For calculating interest on maintenance expenses the rate of six per cent was charged for eighteen months on the items of clearing and preparation, cost of slips, stripping and setting, fertilizers, hauling and applying and hoeing. Six per cent annually was then charged on the items of fertilizers, hauling and applying and hoeing. No interest was figured on the items of picking, packing, containers, hauling, car strips and loading.

The rate of six per cent was adapted in view of the fact that part of the cost of some items on which interest was figured did not run for a year; so that to make the interest charge more equable and more easily calculated, an annual rate of six per cent was charged instead of eight per cent for the actual time the expenses incurred interest.

A number of growers stated that they expected the first crop to pay all the initial charges and maintenance costs, so that succeeding crops would have to bear only the annual production costs. In view of this fact figures are given on the production costs after the first crop. The highest cost per acre was $421.94 and the lowest $204.22.

The average for twenty growers was $255.88 per acre. The yield per acre after the first crop varied from 150 to 312 crates per acre. The average yield being 220 crates.

The average cost per crate after the first crop varied from .88 to $1.44 per crate. The average of twenty growers was $1.18 per crate.

AVOCADO VARIETIES — SELECTIONS FOR PLANTING

Leonard H. Toy, Sub-Tropical Experiment Station, Homestead

The title of my paper is perhaps misleading. It was not altogether of my own choosing and it implies that you will be informed as to the best varieties of avocados to plant. It is not my intention to name several and attempt to assure you that they will prove to be the most profitable. My limited experience with avocados prevents any such recommendations. In fact, growers of long experience hesitate to name unreservedly, any varieties as their absolute choice. The avocado variety question in Florida is indeed an unsettled one. It is unsettled for several reasons.

First: and greatest is the fact that the industry is yet comparatively new. Not only is the growing of avocados in the United States a new enterprise but the fruit itself is unlike any other fruit the consumer has ever been asked to purchase.

Secondly: Few varietal experiments have been conducted under identical conditions of culture. Consequently the results could not be comparable. Until recently little systematic analysis and study of the fruit had been made. And even when we know the differences in composition of varieties, we must await the verdict of the consumer, that final and important judge of all agricultural products.

Finally: Conditions affecting production of avocados since 1924, have been decidedly abnormal. It is during this seven-year period that most

of our more recent promising varieties have come into bearing. We have had no adequate basis for judging their value. Many of them merit further trial, I have been told that the Trapp was, at one time, topworked by many growers to what seemed at the time better varieties. Today the acreage of Trapps compares well with that of others.

I do not feel that my own opinion of varieties or that of any one grower would be of great value to you. So in order to present the representative experience and opinion of a number of growers, I mailed fifty questionnaires to as many growers in Dade County asking what varieties they now owned and what varieties,—named in the order of their preference—they would plant if they were setting out a grove today. In other words I acted upon the advice of a well known manufacturer who suggests that you "ask the man who owns one."

Thirty-four replies were received and are summarized as follows:

The first choice of the greatest number of growers is the Collinson. Lula ranks next, followed in turn by Waldin, Trapp and Pollock. Ranking far below these are the Schmidt and Taylor. Tabulating the replies by another and more significant method whereby each grower's first choice is graded as ten, second choice nine, third choice as eight, etc., the following rating is assigned to the several varieties: Collinson seventy; Lula, fifty-two; Waldin, forty-three; Trapp, forty; Pollork, thirty-nine; Taylor, twenty-six; Schmidt, twenty-four.

In this paper I have purposely avoided considering varieties suited to parts of Florida other than the lower east coast. My knowledge of avocado growing in those sections is even less than that of our immediate vicinity. There are growers in the audience from up the state who, I am sure, will be glad to answer any questions you may have.

I shall not bore you by describing the numerous varieties grown in this section. Many of you are more familiar with them than I. I shall, however, try to picture an ideal avocado, basing my description on some experience and observation and much inquiry among growers, shippers and consumers. The ideal variety should be reasonably easy to propagate, a relatively vigorous grower, with enough foliage to protect the fruit from sunburn. Its average yield over a period of years should be greater than that of our existing varieties. It should have a low, spreading habit of growth in order to shade the ground earlier, to increase the wind resistance, and to facilitate spraying and picking operations. It must be relatively hardy, and resistant to disease and the attacks of insect pests. The *fruit* should have a fairly smooth skin, a regular shape, and preferably a glossy green color. The best size for market purposes is from twelve to sixteen ounces, although larger sizes are sometimes in demand for special trade. The flesh of the fruit should be free from fibre and should possess a good flavor. The seed should be small in proportion to the size of the fruit. As to the oil content I hardly know what to say. Most consumers who have been introduced to the Mexican and Guatemalan varieties with their normally high content of oil like them very well indeed. On the other hand many prefer the West Indians with their comparatively low content of oil.

Satisfactory carrying or shipping quality is another very important requisite.

The season of maturity of an ideal variety is difficult to state because of possible future developments in avocado producing regions. The immediate outlook leads me to name two seasons, either of which would permit the grower to ship his fruit when there is a relative scarcity of avocados on the market. The first extends from June first, to August first, preferably the month of June. The second is the period from the middle of November to February first. There is and probably will always be a profitable but limited local market for avocados maturing later than February first. In discussing the season of maturity I can do no better than refer you to the following paragraph from a paper delivered before the Florida Avocado Association in 1923 by the late William J. Krome.

"The season of maturity may almost determine the value of an entire crop of avocados. Under present conditions fruit maturing during June, July and the early part of August will command prices that will show a good profit to the grower. From the middle of August to the middle of

October, Cuban seedlings, Florida seedlings, and some of the fruit from our budded varieties are all thrown onto markets which are still well supplied with northern grown produce, and until we have the avocado better introduced and more systematically distributed this two months period will be one of little profit to the grower. Beginning about the middle of October or first of November avocado prices usually begin to improve and from then on until the middle or end of March are generally quite satisfactory. These conditions will undoubtedly change as production increases but at present the avocado planter will do well to make his selection of varieties such that there will be least conflict between their maturing fruit and that of other producing sections, or the bulk of production in our own state."

These words, spoken eight years ago are just as true today. We shall never find the avocado variety which is perfect in every detail. We *can* continue trying to improve on those we have at present. The two leading varieties indicated by the above mentioned questionnaire are both hybrids of local origin, which suggests that for future improvement we have been shown the way and would do well to follow.

COMPOSITION OF FLORIDA AVOCADOS

By A. L. Stahl, Agricultural Experiment Station, Gainesville, Florida

PURPOSE OF INVESTIGATION

The work here reported was undertaken for the purpose of gaining some knowledge and throwing light upon the following problems of the avocado.

Avocados are harvested when hard and kept in storage until soft. When it is desirable to harvest fruits before they mature the problem of determining the time of their optimum condition is seldom an easy one and knowledge of their composition at maturity is imperative.

Much difficulty has been encountered in trying to place the avocado in northern markets in a state satisfactory to the consumer, the tendency being to harvest the fruit before it is ready, which results in putting a poor and flavorless product in the hands of the consumer. If picked too early, the fruit has a tendency to become rubbery, shrivelled, and darkened, and lacks the characteristic good flavor of well matured fruit. Its maturity problem thus assumes special importance.

Furthermore, this fruit is now in the first period of its development so far as the American market is concerned. False impressions of its quality created at this time may greatly injure its future. Already some adverse criticism of the avocado, usually traceable to those who have bought and eaten immature fruits, has been encountered.

The greatest problem in the study of changes in composition during growth and maturity investigations is the correlation between the physical appearance and the composition. As a rule it is not hard to decide fairly accurately from its composition at what stage of growth a fruit is in its optimum condition. It is comparatively difficult, however, to correlate this stage with some physical aspect, particularly when the optimum condition desired necessitates the gathering of the fruit some time before it is to be eaten. All fruit reaches a stage where maturity is manifest from its physical appearance but usually when this stage is reached in the avocado the fruit has passed the optimum condition for long distance shipment and storage.

In the search for promising varieties and in breeding new varieties, any knowledge of the chemical composition of the fruit or of changes taking place during growth may be of invaluable aid.

The composition of all the avocado varieties now grown in Florida is a matter of no little interest to the avocado grower.

INVESTIGATIONAL WORK

Methods of Sampling

The fruit for the investigation was obtained from marked trees in the avocado groves of the Brooks Properties, Inc., Homestead, and the Ivey Properties, Inc., Lake Placid. Samples were taken every three weeks from the time of setting until the time of maturity. As far as possible all samples were obtained from a single tree of each of the varieties selected. In some cases the fruit of several trees had to be employed in order to continue sampling throughout the season but, in such cases, the trees were always side by side, having had the same cultural treatments. The trees reserved for fruit sampling were young strong-growing specimens between six and eight years of age. The fruit was shipped to Gainesville where the analyses were made. Samples consisting of four fruits were sent every three weeks and divided at the laboratory into two sets; one set was analyzed at once and the other set stored at thirty-five or forty degrees Fahrenheit and allowed to soften. Before the fruit was large enough to permit a complete analysis of a single fruit, large numbers of fruit were used and the pulp ground and mixed well. The samples analyzed at once are here designated "hard samples" or "A"; the others held in storage until soft designated "soft samples" or "B."

Methods of Analysis

The method of analysis of the Association of Official Agricultural Chemists was used.

Specific gravity of the fruit was determined by weighing it in air and under water. Each fruit was then cut in half, the seed removed, and the pulp separated from the skin. It was necessary to remove the skin of the fresh immature samples by paring. In such cases the separations could not always be accurately made, a fact which must be taken into consideration in interpreting the results. The seed, skin, and pulp were weighed and the percentage of each determined. The following analyses were then made on the fresh edible pulp.

Moisture was determined by drying to constant weight in vacuo at 70° Centigrade.

Ash was determined by the official method for fruits of the Association of Official Agricultural Chemists.

Fat was extracted from the moisture-free samples with anhydrous ether in a Sargent extractor.

Sugar was determined by the Shaffer-Hartmann method, using the cuprous titration.

Nitrogen was determined by the Kjeldahl-Gunning method, the result being multiplied by 6.25 for protein.

RESULTS OF INVESTIGATION

The results of this investigation are given in Tables I to IX.* The data obtained from the analyses of the fruit from the selected trees are presented in these tables. Each figure in the table is an average of two analyses. Tabulations of only representative varieties of each of the races and hybrids are given here, as presentation of the data of all varieties tested would be more than necessary. Table X shows the rank of each variety as to total weight and percentages of seed, skin, and edible pulp. Table XI shows the rank of each variety in per cent of moisture and oil and fat (green basis and water-free basis).

DISCUSSION OF RESULTS

Even a superficial study of the tabulated data reveals many interesting relations between the composition of the fruit and its maturity. As stated previously, the greatest problem in maturity investigations is the correlation between the physical appearance and the composition.

Purple and black avocados change in color during growth. An extended study of these varieties might show some correlation between their color and their composition. In the case of green-colored fruit, however, such an opportunity is not afforded. Neither kind can be left on the tree until soft enough to eat with satisfactory results for, besides the loss in time, there is a noticeable loss in flavor.

The color of the stem has been used as an indication of maturity. This may prove to be practicable with a few varieties but observations by the author lead to no definite conclusions in this regard. The stems of some fruit are green

*See Tables in back of this Proceedings.

after the fruit has reached a mature state for picking, while the stems of other decidedly immature fruits are yellowish. The size of the fruit cannot be taken as a criterion of maturity as small fruits may be ripe when much larger ones on the same tree are decidedly immature. In some varieties the skin of the fruit takes on a sheen or luster when near maturity but in others this is not the case. As far as physical appearances are concerned, it has been impossible to correlate closely any character or set of characters with the maturity of the fruit.

There is, however, a definite correlation between some other characteristics and ripeness brought out by this analysis study. Thus, the time which elapses after picking until the fruit becomes sufficiently soft to be edible roughly indicates whether or not it was in a satisfactory condition when picked. For example, data of the Lula avocado in Table II show that during growth there was a sharp decline in the time necessary for this softening. Fruit picked on September first took 104 days to ripen and the number of days grew less thereafter until only twenty-eight were required to soften fruit picked February first. This change is seldom correlated with the fat content. It appears that the period required for softening is only an approximate indication of a satisfactory condition for harvesting.

The total weight of the fruit and the per cent edible matter increase in all varieties as the fruits mature but there seems to be no line of demarcation which indicates maturity.

The per cent seed increases in some varieties and decreases in others with maturity but in most varieties remains somewhat constant throughout. The per cent skin, however, decreases with maturity of fruits. Here, again, there seems to be no line of demarcation indicating maturity.

Specific gravity of the fruit decreases with maturity. In the very early stages of growth the specific gravity is always above 1.0, being heavier than water. This is always accompanied by low oil content. Just as soon as the oil content increases to any extent the specific gravity decreases and falls below 1.0, being lighter than water. This may be used as a maturity test but whether these correlations could be made year after year under different weather conditions is as yet unknown.

The amount of moisture, of course, varies inversely with the amount of fat and therefore decreases considerably with maturity.

The percentage of ash in avocados is relatively small. While it increases somewhat with maturity, it is hardly possible to formulate a test with this figure as a basis.

The percentage total sugars in the pulp of the avocado decreases markedly as the fruit ripens but the range is hardly sufficient to be of use in estimating maturity.

The protein content becomes higher as the season advances. This constituent seems variable, however, and therefore less available for standardizing purposes.

The fat and oil of the avocado, of course, is its chief constituent other than water and when it has reached its maximum there is no doubt that the fruit is mature. The question arises, however, as to how long it will be before this point is reached until the fruit can be harvested with satisfactory results as far as eating and storage qualities are concerned. The fruit of all varieties tested shows a very small oil and fat content for the first three or four months after setting when there is a decided increase. After this time the fruit will soften or ripen normally and from this stage on a consistent and more or less uniform increase of oil and fat takes place up to a certain point, after which the increase is much less. This fact is brought out specially when the oil and fat are figured on the water-free basis. Often late in the season apparent decreases are indicated, showing at least that the increases were not sufficient to overcome the variability. In the limited experience of the author it would seem that the point where the uniform increase in fat ceases is about the point where satisfactory maturity is found.

One other source of information concerning changes taking place while the fruit is ripening is afforded by the comparison of the data resulting from the analysis of the fresh and storage samples. When these data are confined to the edible portion of the fruit the differences are more striking after the data have been reduced to a water free basis. Many interesting facts are revealed by a close study of these results. Some of them may be the result of errors in the analyses

or of the natural variability in the samples consisting of but four fruits but most of them are undoubtedly the result of changes in composition of the fruit after it is removed from the tree. It is hardly practicable to analyze part of one fruit and store the remainder until it has softened before analyzing it. The best that could be done was to analyze half the number as soon after picking as possible and to hold the other half until they became soft. The data therefore must be considered in the light of these facts. Where changes are almost always in one general direction, the probability of their being the result of individual variation is remote.

The total weight, percentage of edible pulp, and percentage of skin decrease during storage of the samples while the percentage of seed is always higher in the stored samples. This is due mostly to the loss of moisture from the edible pulp and skin.

In all the varieties the storage samples have a much lower specific gravity than the fresh. This, again, is due partially to the loss of water from the fruit.

The percentage of water in the pulp decreases decidedly in all varieties when the fruit is stored, fresh samples generally having a higher moisture content than the stored samples. The ash content shows variations but no definite statement can be made as an increase in ash in the stored samples occurs at one time and a decrease at another. Too much weight cannot be placed on the ash values as different parts of the avocado fruit vary in ash content and it depends upon from which portion the sample is taken as to whether a high or low ash content was obtained. A whole fruit would have to be ashed in order to get reliable data on this constituent.

The protein content shows an increase in all cases in the stored fruit over the fresh samples. Calculation to the water-free basis alters this general ratio to a lesser extent.

There is also a decided increase in fat content in the storage samples and a decrease in total sugar content. At present it is not clear as to whether this is the result of chemical changes occurring during storage or merely of the loss of some other constituent of the fruit. In this connection it is to be noted that the loss of sugar accompanies the increase in fat content. These losses are not always uniform or in proportion to the increase in fat. When it is recalled that the

TABLE X

COMPARISON OF AVOCADO VARIETIES TESTED
(Averages of all mature fruit analyzed)

(Homestead, Florida.)

Rank	Weight		Seed		Skin		Edible Pulp	
	Variety	Pounds	Variety	Percent	Variety	Percent	Variety	Percent
1	Pollock	1.63	Linda	09.47	Pollock	08.10	Pollock	77.50
2	Linda	1.53	Pollock	14.40	Trapp	09.16	Linda	75.82
3	Collinson	1.32	Eagle Rock	14.72	Waldin	11.34	Trapp	74.88
4	Eagle Rock	1.31	Collinson	15.71	Winslowson	11.39	Winslowson	71.74
5	Winslowson	1.30	Trapp	15.96	Taylor	12.58	Collinson	71.50
6	Lula	1.12	Winslowson	16.87	Lula	12.75	Eagle Rock	70.15
7	Waldin	1.03	Taylor	18.22	Collinson	12.79	Taylor	69.19
8	Trapp	1.01	Lula	22.27	Linda	14.76	Lula	64.98
9	Taylor	0.81	Waldin	24.68	Eagle Rock	15.13	Waldin	63.98

(Lake Placid, Florida.)

1	Eagle Rock	1.35	Simmons	14.52	Simmons	09.84	Simmons	75.64
2	Simmons	1.27	Eagle Rock	15.72	Trapp	10.40	Trapp	69.95
3	Winslowson	1.21	Winslowson	20.50	Winslowson	12.10	Eagle Rock	68.50
4	Lula	1.09	Trapp	21.05	Lula	12.12	Winslowson	67.40
5	Trapp	1.08	Taylor	21.70	Wagner	12.89	Wagner	64.64
6	Wagner	0.70	Wagner	22.47	Eagle Rock	15.78	Lula	62.85
7	Taylor	0.66	Lula	25.04	Taylor	18.70	Taylor	59.60

TABLE XI

COMPARISON OF AVOCADO VARIETIES TESTED
(Averages of all mature fruit analyzed)

(Homestead, Florida.)

Rank	Moisture		Oil and Fat Green Basis		Oil and Fat Dry Basis	
	Variety	Percent	Variety	Percent	Variety	Percent
1	Taylor	76.82	Taylor	12.74	Taylor	54.39
2	Lula	77.55	Winslowson	10.57	Winslowson	54.34
3	Eagle Rock	79.91	Collinson	10.56	Collinson	52.15
4	Collinson	80.50	Eagle Rock	10.33	Eagle Rock	50.39
5	Winslowson	81.03	Lula	09.49	Linda	43.74
6	Waldin	81.23	Linda	08.79	Lula	42.71
7	Linda	81.79	Waldin	07.61	Trapp	40.28
8	Trapp	82.16	Trapp	07.25	Waldin	39.83
9	Pollock	86.46	Pollock	04.17	Pollock	30.45

(Lake Placid, Florida.)

1	Wagner	67.85	Wagner	22.53	Wagner	70.33
2	Lula	76.41	Taylor	12.31	Taylor	56.04
3	Taylor	78.36	Winslowson	11.48	Winslowson	51.87
4	Winslowson	78.58	Lula	11.39	Eagle Rock	49.48
5	Simmons	79.47	Eagle Rock	09.75	Lula	49.12
6	Trapp	80.30	Trapp	08.31	Trapp	41.81
7	Eagle Rock	80.74	Simmons	08.23	Simmons	37.70

analyses were necessarily made on different fruits, small inconsistencies can be explained by individual variations in the fruits. The differences between fresh and stored samples are not due wholly to evaporation of water for the differences are maintained when the data are stated on the water-free basis.

With the amount of work so far accomplished it is impossible to attempt to recommend any hard and fixed maturity standard on any of the Florida avocado varieties but many interesting and valuable facts are brought out on the composition and change in composition in the avocado.

The average of the analyses of the standard avocado varieties cannot well be used as a basis for comparison for the reason that samples were taken at different stages of maturity. Averages were made, however, of all the mature fresh fruit analyzed and the constituents of the different varieties compared. Tables X and XI were arranged, therefore to show the order in which each variety ranked with respect to each constituent. The figures on these tables are averages of twenty to forty fruits. The maxima are given first rank in case of weight, edible pulp, and fat; the minima in the case of seed, skin, and moisture. When the differences are small these figures should not be given too much weight as the relative position of the variety might be changed by another set of data obtained by trees differently located. It might be better, therefore, to rank the varieties by groups only.

When mature the Pollock and Linda rank first in total weight, averaging well over a pound and a half, and the Taylor ranks last, averaging four-fifths (4-5) of a pound. The Pollock and Lindo rank first again in the per cent edible pulp with Lula, Taylor, and Waldin ranking last. Linda and Pollock rank first in per cent of seed, having the smallest seed, while Lula and Waldin rank last, the seed constituting about one-fourth (1-4) the total weight. The smallest per cent of skin is found in the Pollock, Simmons, and Trapp and the largest in the Taylor and Eagle Rock.

The Taylor, Wagner, and Lula varieties have the lowest moisture content, the highest being found in the Trapp and Pollock. The oil and fat content is found to be highest in the Wagner,

Taylor, and Winslowson and lowest in the Pollock, Trapp, Waldin, and Simmons.

In breeding work and in varietal selection the results of the comparisons of varieties in Tables X and XI would be of invaluable aid.

A survey of the data presented in the accompanying tables shows the avocado to differ widely in many respects from the average for fresh fruits and proves it worthy of special considera tion. It might well be said to be in a class by itself.

The tables are replete with interesting points, all very favorable to the avocado. The total dry matter in the edible portion of mature fruit is greater in nearly every instance than that noted for any other fresh fruit, with the exception of the banana which has about an equal amount. Sugar and starch predominate in the banana as against fat in the avocado.

As far as protein in fresh fruits is concerned the avocado stands in the lead. The carbohydrate content of the avocado is low as compared with the constituent in fresh fruits but contains on an average fully fifty per cent of that found in many fresh fruits.

It is also of interest to note that the percentage of mineral matter or ash in the avocado is equal to that of most fresh fruits and higher than that of many of them.

The chief value of the avocado as food is due to its high content of fat. The avocado ranks higher in fat and oil than any other fresh fruit with the exception of the olive which is its equal.

These facts alone would warrant due consideration of the value of the avocado as a fresh fruit.

PAPAYAS

By Bronson Bayless, Miami, Florida

The Papaya is a tree melon that grows in the tropics, is well known in hot climates and is extremely healthful. Dr. Kellogg stated that among the 600 fruits known to the world, the Papaya ranks well up among the leading twelve and contains a liberal amount of all the vitamines from A to F.

The stalk is hollow, the leaf stem is hollow and the fruit is hollow and the plant has two sets of roots, a tap root that works downward as far as it can and seems to supply the water and the feed roots that work laterally close to the top of the ground. These roots are not hollow but form a solid base to the stalk three to six inches above the ground. The stalk is similar to bamboo except that it is herbaceous and not woody. The leaf stems attach direct to the stalk, are sometimes three to four feet in length and at the end is a wide spreading leaf of tremendous size, two feet wide, sometimes three or four feet long. The leaves of a mature tree indicate the definite shape of the fruit and the stalk naturally sheds the lowest leaves which drop off with a clean break in a healthy tree. The terminal at the top of the stalk grows on putting out more leaves and carrying the tree higher.

The fruits form at the junction of the stalk and leaf stem, and are attached to the stalk direct—first there is a blossom long and cone shaped, and when the blossom opens its petals there is revealed, in a female tree a perfect fruit one to two inches in length. The male tree carries at the same junction a long stem that bears a great cluster of blossoms, smaller and more slender than the female blossoms. They are beautiful and sweet smelling and contain honey but so deep the bees cannot reach it. When the petals open there is no fruit, only pollen. A bisextual tree has its stamens within the blossom either attached to the petals or at the base of the fruit. Many of the bisextual blossoms contain no fruit, only pollen as does a male tree.

A male will bear no fruit at all, and a female, the greatest quantity. The bisectual tree falls in between and bears a greater proportion of fruit as it approaches the female and a lesser propor-

tion as it approaches the male. The fruits from the true female conform to a more or less standard size and shape whereas in the bisextual, many shaped fruits are formed, mostly long bottle shaped fruits that hang on long stems. Sometimes there are only one or two fruits to the tree on long stems and are of no quality or size and are unprofitable.

From time of setting in the field to fruiting is about four months and an equal time is required to mature these fruits and begin to yield ripe melons. The tree continues with blossoms at the top, forming perfect fruit of small size and growing larger toward the bottom. The fruits are not seasonable, blossoms and ripe fruit are on the tree every month of the year that its kind of weather permits. A fair estimate of a good profitable tree is 125 pounds of fruit a year. It is estimated in pounds instead of in number of fruit for as a rule the smaller the fruit the more there are in numbers on a tree. The most remarketable size is from three to five pounds, oblong in shape, yellow when ripe, smooth on the outside, lobes inside, thick meat but above all sweet and tasty.

An exellent Papaya requires no educated taste to be thoroughly enjoyed. It requires no salad combination, whipped cream preparation or other condiments for the taster to get a genuine kick.

The public is open to take on the Papaya, gets a thrill out of its rapid, bountiful growth and wants to enjoy them. There is a quick market for a good Papaya. In fact, there is not enough good ones for the demand. Better fruit will increase the demand. So that the definite conclusion is that there is a need for production of a better fruit. The problem of marketing is not such a vital element just now, as is the proposition of better fruit and consistantly better fruit.

Probably you would like to know some of the problems of the producers. The weather conditions form one big item and are subject to less control by the grower. The Papaya is a herbaceous plant, very rapid in growth and in bearing reflects every excessive dry spell, every excessive wet spell, every excessive cold spell or wind, in the fruit as it ripens. A dry spell will create a stiff spot in the stalk, that is hard to overcome. Wet weather is inclined to rot the roots, stalk and fruit; and cold and winds will dry out the leaves and drop them leaving the stalk almost bare and the fruits ripening under such conditions show poor results. Overhead irrigation will take care of dry and cold conditions; high land will care for wet. I know of nothing that will prevent hurricanes from taking the stalks down, but if the trees are well nurtured and strong in the fall season they will stand much of the hardships of the winter elements.

Breeding is the most important item. Although wind, water, and frost period do no harm, the crop is a failure if poor fruit is produced. How often have we heard that the Papaya will not come true—too many throwbacks and too many different kinds of fruit from the seeds of the carefully selected melons. As a matter of fact there is no reason whatsoever to expect that such seeds will produce like fruit. It is true that the fruit was good. The tree from which it was taken may have been alright, but how about the pollination? Where did it come from? To illustrate the situation by animal life, if a fine leghorn hen ran in the neighborhood where there were barred rocks and reds, good roosters and bad roosters, what would be the result in chicks hatched? Or if there was a good tree in a Papaya patch and it was properly pollenized from an apparently good male, to attempt to breed good fruit, wouldn't the result be the same as if one tried to breed leghorn hens from a wild flock of chickens. There would be too many inbred throw-backs and after years, one would get nowhere.

So then, if known seeds of more or less segregated varieties from foreign countries be produced as a foundation and carefully and painstakingly breed by definite pollination, and by careful selection of strong trees, good tasting fruit, smoothness of skin, color when ripe, shape, size, etc., one might get somewhere in the course of a few years.

The Papaya can be grafted and sprouts can be rooted, but not with good success. Such trees are not strong producers nor are they profitable.

The better fruit of the Papaya comes from a tree that has had an even steady growth, not slowed up and then pushed; the stalk even in size, not bulged nor crooked. Crooked and ill

shaped fruits are to be cut off, maturing only satisfactory fruit with not too big a burden on a single tree. If the tree enemies make inroads into the patch those trees with the largest burden are the first to succumb. Too rapid growth does not produce the best fruit.

The handling of Papaya for the retail trade must be carefully done. The fruit should be picked twenty-four to thirty-six hours from dead ripe. It will not ripen in the ice chest nor is it best to put it in the sun but it should be put in a shaded temperate place. Keep until soft to the touch, soft as a banana. So soft that the mouth squashes the fruit. No need to chew. You don't chew a ripe banana. If brought to the counter in a less ripe condition, the loss is more than fifty per cent by handling and testing with the fingers.

Shipping direct to the customer is not difficult but it is hard through several parties or brokers. A knowledge of the day and hour the fruit of a certain variety will be ripe or even of a specific tree is required. It is figured to arrive at destination in a stiff condition and ripen after arrival, like a banana.

Propagation. The seed are broadcast in proper trays and transplanted to pots and cans for sizing until ready for the field. It takes twenty-one days to sprout them, and thirty to sixty days to size them. This should be done in the sun so that the plant will be accustomed to heat when set out in the field. Two plants are put in each hill, one and a half feet apart, so as to have space to carry plants to blossoming time when elimination of males, or in case of bisextuals, unsuccessful plants are pulled out.

The trees should be ten feet apart. If the rows are eight feet apart and plants ten feet and staggered, twenty per cent more trees can be planted to the acre with a distinct advantage in wind break.

Our method of fertilization is to feed them chicken manure or any organic matter up to fruiting time and then the best grade of commercial fertilizer from reliable makers, each month. Place well out to the edge of the leaves up to ripening time when fertilizering must cease, for awhile. If trees are planted in the spring, the growth of the tree should come in the first wet season and the growth of the fruit in the second wet season. In July, August and September use one pound or more each month of high grade sulphate of potash to each tree, either in the commercial fertilizer or alone.

Leaf Spot and anthracnose are controlled by spraying four pounds each of lime and bluestone and fifty gallons water in and around the leaves, fruit, terminal and stalk, say twice during August and September.

The large green worm that eats the leaves is poisoned by arsenate of lead spray, but you will lose the chameleons, lady bugs and friendly insects. The corn borer or pickle worm is a dangerous pest, and succumbs to no spray that we have used; take a slender stick and dig him out of his webbing and kill him. He will drop your blossom and your fruit and still more serious, bore into the stalk and stop the "plumbing."

The Papaya fly has given us but little trouble We have not found such a maggot in a fruit yet. We allow no fruit to stay on the ground and thus eliminate his chances of pupating if he should be within the fruit and all neighboring planters should be urged to do likewise. His cycle is short and by allowing no drops he can be kept out.

Cut all undesirable plants immediately upon discovery and waste no time on them even though the fruit is formed. The sacrifice will be greater if done later on.

Papaya makes excellent jams, preserves, marmalades, pickles, and wine.

Our Papaya patch contains 1,148 bearing trees, all of which we bred by hand pollenization from known trees. A drive-way runs down the centre of the patch, on the east side all are male and female varieties and on the west side are bisextuals. The males are on the outside of the fence and are of known breeding. All trees are numbered alphabetically from east to west and numerically from north to south, and we keep books on each plant in a definite location and know the mother and daddy of every tree. We hand pollenized 1,200 fruit last summer and fall, from which we have gathered just ten pounds of seed. This work I did personally, carrying forward for the year eight distinct definite breedings—Honolulan, Venezulan, Panaman, African, Haytian, Costa Rican, Cuban and a cross between Honolulan and Panaman.

Personally, it is the most interesting work I have ever done and each day, week and month I am that much more interested in Papaya.

On Dec. 1, 1930, our crop bid fair to give excellent returns, but the continued cold winds of December through February have cut the crop fifty per cent, but still we had some excellent fruit and it is most interesting to note just which varieties survived the shock and came through in better condition.

Papaya is a crop that has blossoms and ripe fruit every month in the year; its enemies are wind, excessive water and frost; and its friends are showers, hot days, hot nights, and hot sunshine. It grows in the summer time when other crops in the tropics fail.

Member: We grow these in Brownsville, Texas. I notice Mr. Bronson did not call attention to the use of the leaves in making the meat tender?

Bronson Bayliss: I have never tested it out.

Member: The Mexicans in our territory take a piece of tough meat and wrap it in one of those leaves, and it will cook all to pieces.

Member: I had some trees in my back yard, and one of the trees grew very rank, as nice as it could be. There were several nice fruit on it, and they all shriveled up and dropped off. The leaves turned brown, and the fruit shriveled up and everything dropped off.

Bronson Bayliss: When did the shriveling commence?

Member: Within the last month or five weeks.

Bronson Bayliss: It was probably due to the excessive cold we have had. If it was close to a septic tank it may have had too much fertilizer.

Member: It had plenty of fertilizer. You think it was the cold weather that caused these brown spots on the leaves?

Bronson Bayliss: Yes sir. That's an indirect result of the cold. Anthracnose, we call it. This will succumb to Bordeaux spray, which should be put on in August and September several times to prepare the tree for winter hardships.

Mr. McBride: What has been your experience in growing Papayas on the rock soils around Miami?

Bronson Bayliss: I would hardly be able to answer that except in a general way. We are on three or four foot of sand. We would rather have a place where the tap root could go down than to have rich soil. We have seen many trees in the Redlands, and are inclined to think the trees there were limited in the amount of fruit they could put on, because when they were torn down in the hurricanes they showed but little clusters of roots below, insufficient to feed a number of fruit, and to keep a tree in good healthy condition, so as to produce sufficient fruit, and quality fruit that would be profitable.

Mr. McBride: Do you think sandy soils are satisfactory?

Bronson Bayliss: I do not think the plant is particular as to the soil in which it is planted, but I would like to have a location where the tap root can go down. It is more responsive to the fertilizer.

Mr. McBride: In sand, how far would a tap root penetrate?

Mr. Bayliss: I am inclined to believe that the tap root will go almost as deep if left alone, as the tree grows high.

Member from Texas: You are right about that.

Mr. Bayliss: But it must have the soil to grow in, but if it extends only half a foot below the surface the plant is subject to the dry weather and wet weather changes.

Mr. Price: How old do your trees live to be?

Mr. Bayliss: We are unable to answer that exactly. Our entire patch went out in September, 1929.

Mr. Brooks, Miami: We could show you some Papayas in the rock lands or red lands some of which are three and one-half years old, that have been allowed to grow without being cut back. Others have been cut back twice, and are producing new shoots and new fruit that came up from the old stalk. We have trees three and one-half years old that are still bearing and I would say, commercially, except for the damage from the storm. I have seen trees growing from the rocky land here in Miami as much as seven and eight years old, where we had to use an eight-foot ladder to pick the fruit from the trees.

THE CAJEPUT TREE FOR FORESTING FLORIDA'S UNDRAINED ACRES

A. H. Andrews, Editor of The American Eagle, Estero, Fla.

What to do with Florida's undrained acres is a question that has greatly interested the writer since first coming to Lee County some thirty-seven years ago. It is probably no exaggeration to state that two-thirds of the area comprising South Florida is deficient in natural drainage, owing to the level character of the country which affords little run-off for the excessive rainfall during the summer season. Included in this classification are vast areas of pine flatwoods, prairie, ponds and cypress swamps. Similar conditions prevail in a lesser area throughout central and northern Florida as well.

In many instances drainage is possible, but few care to go to the expense of buying wet lands and ditching them when they can purchase acreage with natural drainage for practically the same price, and thus it is that our undrained areas lie unproductive year after year—too wet to grow merchantable pine timber and a burden to the taxpayer who eventually gives up in despair and allows the property to revert to the state. But why not solve the problem of Florida's wet lands by taking the course of least resistance? Why go to the expense of draining these vast areas when possibly we can utilize them as they are? Surely somewhere throughout the length and breadth of the tropics there must be something of economic value that will grow and thrive under Florida wet flatwoods conditions. Naturally, timber suggested itself as the logical answer, inasmuch as it is in universal demand and adapts itself better than most crops to wild and uncultivated environment.

Beginning about 1903 and continuing over a period of six or seven years, experiments were made by the Koreshan Unity at Estero with more than twenty varieties of Eucalyptus timber and several were found to be admirably adapted to the high hammock and pine lands of South Florida, though none gave promise of successful growth under wet flatwoods conditions. Numerous references to Eucalyptus at Estero will be found in Forest Service Bulletin No. 87, by Raphael Zon and John M. Briscoe, entitled, "Eucalyptus in Flordia," published under date of 1911.

The utilization of Florida's undrained acres remaining still an unsolved problem, our attention was next turned to Australia, a land of wonderful timber resources with a climatic range very similar to that of Florida, though extending in its northern area even into the torrid zone. Through a fortunate circumstance in 1911 the writer came in touch with Mr. B. Harrison, a seedsman and farmer of Burringbar, New South Wales, and an extensive correspondence developed. Conditions prevailing in the Florida flatwoods during rainy season were described and the question asked as to whether there was any Australian timber of commercial value that would grow and thrive in wet land. Under date of June 5th, 1911, Mr. Harrison sent a description of the Cajeput Tree (Melaleuca leucadendron) which he recommended highly for trial in Florida.

Seed was shipped us by Law, Somner & Co. of Melbourne under date of Jan. 25th, 1912, and ere long a quantity of fine young trees were growing in the nursery at Estero. Several people owning flatwoods homesteads near Estero were struck with the beauty of these Cajeput Trees and obtained a number which were set as ornamentals along their fence lines. Time went on; the homesteaders abandoned their wet farms; grass and weeds took possession; the houses eventually burned, but the Cajeput Trees grew and prospered as in their native element, making rapid and substantial growth in land too wet and poor to produce merchantable pine timber.

It was discovered some years later that the Cajeput Trees were seeding themselves over a wide area of wet flatwoods, and even on down into the cypress swamps where they are disputing possession of the ground with the native timber. Not until then were realized the tremendous

possibilities of this tree for reforesting wet cut-over lands, and also as a cover crop for large undrained areas that were hitherto practically treeless. On high, dry land the Cajeput grows almost equally well, but observation over a period of years reveals the fact that it will not seed itself under such circumstances, hence is unlikely to become a pest to the farm and grove owner.

The Cajeput is a tall growing myrtaceous tree with glossy, evergreen foliage, contrasting strongly with the creamy white color of trunk and branches, and being highly prized for ornamental planting. It blooms several times a year, the white flowers being borne in clusters, resembling in form the flowers of the Bottlebrush, to which it is related. The seed is borne in warty looking capsules which adhere tightly in clusters to the smaller branches. When dry, the seed-capsules open, sifting out their contents which is exceedingly fine and much resembles tobacco dust. The seed is carried by wind and water—and probably by birds—and when finding lodgment in soil of sufficient moisture, germinates readily. Isolated specimens of this tree have already been found in the forest some miles remote from the original planting, and as they bloom and seed at an early age, indications are that within but a few years they will become a familiar sight throughout the South Florida wilds.

The bark of the Cajeput is spongy and cork-like in texture, but differs from cork in that it is laminated like thousands of sheets of tissue paper tightly compressed. It suggests possibilities for high grade paper making and in Australia is commonly known as the "Paper Bark Tree." This bark is not fireproof, as is sometimes stated. Like wallbobard, it will burn readily when shredded, but in its tightly compressed form is highly fire resistent. It thus has undoubted value as insulating material against both heat and cold. Fruit packed in the shredded bark is said to keep well for months at a time. As the tree develops the outer layers gradually loosen and may be readily stripped from the tree, leaving a moist inner bark of ample thickness to provide protection. It is not uncommon with the larger trees to find outer layers of loose bark an inch or more in thickness.

The leaves of the Cajeput possess a high content of a pungent medicinal oil of agreeable odor and analyzing practically the same as Eucalyptus oil which is highly efficacious as an inhalent for coughs, colds, asthma, bronchitis and other affections of the respiratory system. Cajeput oil is imported regularly from the Orient and is used effectively for external application in rheumatic ailments. It is sometimes taken internally for intestinal troubles. When the new flush of growth is on, the air for some distance is perfumed with the fragrant odor.

Cajeput wood is hard and of very beautiful tint, shading from gray-brown to rose tint in the heart wood, and should prove valuable for fine furniture and interior woodwork. It is said to be highly resistant to the attack of termites and other destructive insects and almost indestructible underground, being highly valued for railroad ties, piling and fence posts. There is a slight odor to the wood and it is said to have been used successfully as a substitute for cedar in the lining of moth-proof closets.

The greatest hazard in forestry work is woods fires. Herein the Cajeput possesses a distinct advantage in that it grows its own fire protection and when once established is practically immune from damage from this source. It has no known insect enemies and cattle are not known to eat the foliage. Equally at home on high or low land, in rich or poor soil, in fresh or brackish water, it is said by Baron Von Mueller to attain a height of eighty feet and a diameter of four feet on tidal flats in Australia. In its native country it is said to thrive down to thirty-four degrees South Latitude, but its climatic range is as yet undetermined in Florida. We would estimate roughly that it will grow as far north as most varieties of Eucalyptus, to which it is related.

Like any other tree, the Cajeput appreciates fertile soil and good treatment, though it will grow under most discouraging conditions. We have trees in Estero which have grown up to eighteen inches diameter in eighteen years in poor flatwoods land and under crowded conditions. A year ago we learned of some large trees at Davie, some nine miles west of Fort Lauderdale, and made a special trip to see them. We found

there a row of apparently some fifty trees ranging up to two feet or more in diameter. These trees, we were informed by Dr. Fairchild, were planted in 1914, and hence were sixteen years of age at the time of our visit. They are growing in a conglomerate of rock and muck. Not a bad showing for hard wood trees in sixteen years! Mr. Blakely of the Kelsey City Nurseries told us that he had moved some of these big trees and reset them successfully on several Palm Beach Estates.

As an ornamental the Cajeput is growing in popularity. We have seen them in street plantings in Sarasota and St. Petersburg. In Tampa many have been planted in the park strip along the Bayshore Boulevard. On April 4th of this year, under the auspices of the Tamiami Trail Blazers, some 200 of these trees were planted along the Tamiami Trail at the north and south approaches to Estero, one of these trees being set by Mrs. Edison with appropriate ceremonies. The Spur Magazine for February featured views of the Harold Vanderbilt Estate at Lantana, Florida, in which the Cajeput plays a conspicuous part in the landscaping. Both sides of N. W. 36th Street in Miami, opposite the Air Field, are planted with young Cajeput Trees and a number of them may also be seen at Hialeah.

Great as are the merits of this tree as an ornamental, its real ultimate value to Florida lies in its commercial possibilities. Summing up the case, let us note that wood is the universal building and manufacturing material; that it is in tremendous and continual demand and that the supply is growing less from year to year. Also note that in Florida there are vast areas of undrained lands that are idle and unproductive year after year and reverting to the state for delinquent taxes. A tree has been found which thrives in these wet lands, produces a valuable hard wood, seeds itself over large areas, has no insect enemies, is not eaten by cattle, is fire resistant, sprouts from the stump when cut, and whose bark, bloom and foliage are commercially valuable.

Industries and year-round payrolls are what Florida sorely needs, and industries cannot thrive without the raw material to keep them going. In view of our presentation of the case in the foregoing argument we would ask the members of the Horticultural Society as the jury to decide the question as to whether or not the Cajeput Tree is worthy of extensive planting throughout Florida's vast area of undrained and unproductive acres.

Acting independently of government aid, and with no knowledge of experiments being conducted by the Subtropical Experiment Station at Miami, the writer was at first inclined to the belief that his introduction of the Cajeput Tree in 1912 was the first in Florida. A subsequent talk with Dr. Fairchild has convinced me that Dr. John Gifford's experiments with the Cajeput antedated my introduction by several years. However, it was the Lee County planting that demonstrated the tendency to seed itself in wet flatwoods soil and it is through the columns of The American Eagle of Estero that it is being advertised and promoted as a merchantable timber tree for putting to profitable production large areas of Florida's undrained and idle acres.

L. B. Skinner: Is it evergreen or deciduous?

A. H. Andrews: The tree is evergreen. I call your attention to the bark. Notice the thickness. I believe it has wonderful paper making possibilities.

THE BAMBOO

A Much Needed Source of Raw Material for American Industry and a Scenic Asset

James Prentice, Col. U. S. Army, Retired, Coconut Grove, Fla.

When the Florida Horticultural Society asked me to deliver a short address on the subject of bamboos at their Miami, Florida, meeting I accepted with some misgivings as to my ability to do the subject justice, for, as you perhaps know, I am really an amateur in things horticultural.

My attitude toward bamboo is that of a zealous agitator for its introduction and extensive cultivation in the United States for reasons that I will explain.

While my interest in bamboos was originally aroused in the 1890's, when we were groping toward the solution of the problem of flight, it was quickened and intensified by some incidents that occurred in the Orient between 1910 and 1914 when I was on various missions there, mostly in the Philippine Islands.

I took a company of coast artillerymen to Corregidos Island in Manila Bay when we were building the fortifications. The men lived in tents which were blown away by a severe tropical storm. There I was thousands of miles from home in a strange tropical land with an unsheltered command and no tentage to be had until the next transport was due perhaps a month later. I noticed that the natives lived in simple little buildings consisting of frames of giant bamboo covered with nipa palm shingles tied on with rattan strips. I found that on some government land below Mount Miravales there were great groves of bamboos and that I could buy the shingles and rattan and get the services of native workmen at very low prices. So I took the men to the mainland on a mine planting steamer and in a day we cut enough poles to build a cantonment. Inside a week the company was housed and dry and contented. When after about six weeks our new tentage arrived we had it stored in mildew proof packages and the men preferred to stay in the bamboo houses. We used these about three years and when I left in 1914 another company was using them.

In my walks about the native barrioso as they called their villages, I noted the many uses they put the bamboo to. For instance they carried water in big bamboo tubes that they balanced over their shoulder and carried like a rail. Their sail boats had bamboo masts and outriggers. They hung their wash on bamboo slats supported on bamboo uprights. They made fish weirs of split bamboos supported on bamboo piling. Their wharves and bridges were bamboo. They had irrigation systems in which bamboo piping carried water long distances. They locked up their cattle and poultry in bamboo inclosures. When they shipped things they used bamboo baskets and specialized packages of split bamboo. They made chicken shipping crates of it. Most of their furniture was of bent and split bamboo. Their hats were generally of split bamboo with bamboo sheaths. They made many little things of artistic appearance from it and where we would be splitting up a fine big board to make a small strip of wood they used a split piece of the finer grades of bamboo. They surrounded their estates with the most fascinating arbors of bamboo over which ran interesting and often beautiful vines.

So it dawned on me what the bamboo really was to these people. I saw that I was in the midst of a civilization which for thousands of years had been developing the arts of bamboo culture and its application to domestic economies and industry in general. For the three years and a half that I was in the Orient, in China, Japan, the Philippines, in Corea, on the Island of Formosa and in the Malay Countries and in India I never wearied of studying this strange and useful plant. I found very little literature on it although it was constantly referred to in their literature and portrayed in their art. They took it for granted just as we take lumber and iron products.

The charm it lent to their landscapes has made an indelible impression. The majesty of the greater giant species is not matched by anything we have in America. Some clumps I saw with my own eyes were a hundred and ten feet tall. Just think of a stem of grass, for bamboo really is a grass, as tall as a ten-story building. Think of the engineering of nature in a structure like this with every foot a part of a curve of beauty bearing at its top a filigree of lace-like leaves that responded to every zephyr. Think of a beautiful brook meandering through groves of these with the little farm houses shaded and protected from the terrible storms by these resilient and tireless guardians.

In the Philippines they have a storm season, the typhoon season, that corresponds to the West Indian hurricane season. I went through a dozen of these in about three years with wind velocities that averaged a hundred miles an hour. In the lee of the bamboo wind breaks I always felt safe. In the fields and villages so protected the

work went on during most of the storms unless the rainfall was excessive. The natives of course hugged the windbreaks. The laboring of a giant bamboo windbreak during a typhoon is a sight that inspires the observer. They seem to throw the wind upward as they bend before it and then slowly and majectically rise to await the next surge of the tempest. When the storm is over there are a few less leaves but inside a week these are replaced, the few stalks that are shattered are harvested and used to build fences and the farm or village resumes its normal aspect, waiting indifferently for the next big blow that they do not fear but merely take as a matter of course.

I arrived in Florida in 1926, about two weeks after the big hurricane. It was a terrible sight that met my eyes. It brought back to my memory the way the Philippinos and Chinese and Japanese took such catastrophies. Here there had hastily been gathered a mixture of people building a new civilization who were ignorant of the storms of the subtropics and the need of windbreaks if there is ever to be a successful agriculture. Little light wooden houses on light foundations without anchoring had been used to shelter families in open spaces without the protection of even a few pine trees. Great pine trees had been uprooted and had fallen on frail buildings, destroying them. I heard tales of great hardships of people who had been caught out in the open when the wind came suddenly upon them. None of them had known what a friendly bamboo clump or a windbreak miles long could do in such an emergency. So I said to myself that probably the greatest good I could do for the people of the state I had selected to make my home would be to tell them how to protect their lives and their property against these storms that are inevitable but not necessarily desrtuctive if we will understand them and be prepared for them.

Bamboos are a scenic asset to a country like this because we have so little skyline effect. We have stumpy vine-clad trees that move only in the hardest winds and then with graceless movements. If it were not for the palms we have imported it is doubtful that there would be a curve of beauty in an entire landscape. We have much color it is true but color is not beauty. It is to proportion and shape that we look for true beauty. We need the matchless curved lines of the bamboo and its lace-like foliage, dancing in every light breeze, to complete our landscapes. No tropic scene devoid of bamboos is complete.

I have given very little attention to scenic bamboos, but in China and Japan I noted that they exploited many shapes and sizes in beautifying their estates, everything from a potted gem of living lace to a giant that rose up into the heavens and at noon time made moving shadows that tempered the mid-day sun and in the moonlight filled the air with mystic curves.

A very old man can plant a giant bamboo and inside three years can see it attain the dimensions of a forest giant. Here if we plant a tree we must live fifty years more to even see it shade our house. If the bamboo is appreciated as it should be and we have an era in which it is widely distributed we will see our landscapes transformed quicker perhaps than by any other method.

It is to this dissemination of information of the simplest facts about bamboo types suitable to this region and practical ways of making them grow that I have dedicated considerable time, effort and expense during the past three years.

To begin with soil is a very important factor in raising bamboo just as it is for most plants. The Chinese and Japanese types as a rule are what we call the running types, that is they spread underground by runners much like Bermuda grass or mating cane. They must be planted with great attention to their probable spread for they will overrun great areas if not restrained. These types generally do best in clay loam soils, acid soils. They do very poorly in the calcareous or limy soils. The Japanese bamboos are really the best material for the arts and industries having the finest and firmest grain and greatest resilient life and strength. These can be raised in North Florida, South Georgia and the other Gulf regions. They are very happy in Louisiana and in southern California. Some hardy running types that make good fish poles and furniture material will do well as far north as Washington, D. C. I saw groves in Japan that were said to be laden with snow in winter, but they looked very healthy and erect.

The most beautiful of the bamboos are the clumping types. These have among their types the greatest of the bamboos. They come generally from India and Malaysia. In the Philippines the giant clumpers grow best in certain alluvial loams and in the volcanic dobie soils that were washed from the sides of the mountains. They often were found on stony soils that were very calcareous. It is to these lime tolerant types that Dade County must look for any hope in bamboo culture. If an acid type of bamboo is set out in limy soil it grows slowly and is almost straight. It is easily broken in a high wind and subject to many diseases and insect attacks. The frequent attempts to use acid bamboos in Dade County are what have given the bamboo a bad name here.

Bamboos need plenty of colloids, those minute particles of iron, aluminum and silicon that are really the difference between mud and sand. The outside of a bamboo stalk is as hard as glass and is probably pure silicon. I have seen Chinamen take a sliver from the outside of a bamboo stalk and make a knife blade of it that would cut vegetables and soft meat. This silicon must come from the soil. That is where the clay loam, with its wealth of colloids, comes in. But here in Dade County, along the edge of the muck lands there is a zone of colloidal muck on which bamboos do very well. The colloids perhaps were washed off the adjoining low sand dunes. I located and am exploiting a small patch of colloidal muck near Opalocka to start an experimental nursery for timber bamboo. Our muck is calcareous, due to the presence of lime water in the many streams, both surface and subterranean, that flood and drain the Everglades. So I have been obliged to confine my efforts to lime tolerant types.

Bamboos like plenty of water but don't like to stand in water. Stagnant water soon kills them. They like to be about four feet above the water level of a stream close to its bank. They have feeder roots that spread out sidewise and rob every plant within twenty feet and another set of coarser roots that go down for water. When we plant bamboos we should see to it if they are on high sandy soil that they have a column of colloids, preferably colloidal muck, below reaching down toward water. Once they get a start and enough water to tide over the first year they will survive.

The three principal ways to propagate bamboos are to use seedlings, to use cuttings of the stalks as slips for starting new clumps and to cut up blocks of the root system for transplanting. The latter method is the quickest but most expensive and laborious. The seedling is the best plant if made to live. If a pole is cut up into pieces and buried about four inches in a moist trench a new plant will start from each joint. If several joints are in a piece of pole they must be nicked between joints to permit water to get in.

Seeds can be procured from the Orient from the Department of Agriculture who get them and propagate them under strict surveillance. Bamboos are liable to transfer diseases and insects and the United States Department of Agriculture has the sole right to bring them into the country. Florida has strict quarantines against most of the states where bamboos are raised for the trade. If we exploit the clumps of suitable bamboo that we already have in the state and get the United States to help us with seedlings we can quickly make a big showing at little expense.

Bamboos have varied life spans. They generally go to seed when about twenty-five years of age and die leaving only the seeds, like other grasses, to maintain the species. Of course the running types live longer since they die in places and spring up elsewhere like Bermuda grass.

Bamboo clumps should be cleared out every year of over ripe stalks and broken and diseased members. The poles grow about twenty-four inches a day during the growing season, rising as a branchless stalk of asparagus until full height then suddenly the lateral branches spring out. The bamboo hardens slowly and really a stalk is not fit to use until about three years after it is born. A stalk may linger along until it is ten years old but after three or four years it begins to lose quality and it is best to have only young stalks in a clump whether it is used for scenery or as a source of raw material.

Bamboos have several scale enemies. They must be watched for these very carefully. The best way to get rid of a scale epidemic is to cut a clump down and after passing the poles over

a fire to kill the scales apply fire or whale oil soap to the stumps and let a new growth start. The poles thus cut down can be used on arbors or slat houses after being seasoned and dried long enough to kill the scales and certain soots that will form on green poles that are left out in the weather. Take steps to suppress ants near the roots with poisons such as cyanogas.

A man who sets out some seedlings and cuttings and root transfers can expect to begin to have small poles at the end of three years and by the end of five years will begin to have about all the poles he needs for arbors and fences about his place and some to sell or give away.

As we extend our agriculture out over the Everglades I expect to see many clumps planted near the homes or camps of the farmers. There will be bamboo frames for the small sheds and work sheds, bamboo bridges over canals and bamboo fences and chicken coops under bamboo arbors on which they will raise chayotes and cucumber and other squashes. Bamboo pipes will be used in watering plants and a thousand little things pertaining to the domestic economies will be fabricated by people who without the bamboo would probably spend dreary days on a great open plain devoid of skyline but who with it can feel that they have at least a substitute for the forest to draw upon when they wish material to make the things they need.

Bamboo is a solution to many of our problems here in Florida if we will only exploit it. We need it and America needs it to help save her forests.

Dr. David Fairchild: I am interested in the bamboo, and perfectly delighted to hear this paper, but the speaker left out one very important element—he did not say anything about the edible bamboo. The bamboo shoot is one of the most delicious eatables in the world, and appreciated by many people.

Mr. Price: Were those larger varieties grown in Florida?

Mr. Prentice: These pieces came from Georgia. I have had larger pieces than this, but mine were young, and I had given away the larger pieces, but we can raise them as large or larger than this. I have some over five inches in diameter only three years old, and forty-four feet tall.

Dr. Fairchild: We have a special bamboo garden at Savannah, where we have two and one-half acres of Japanese Dipper Bamboo fifty-five feet in height. We built a bamboo museum, which will be open next fall with exhibits of bamboo, and if any of you are going north, stop thirteen miles this side of Savannah and see that museum; take a look at the largest grove of Dipper Bamboo in the eastern part of America.

PROBLEMS IN CONNECTION WITH COLORING CITRUS FRUITS

J. R. Winston, U. S. Bureau of Plant Industry, Orlando, Fla.

In the early days of fruit coloring, some fifteen or more years ago, there appeared no serious complications in the offing in connection with the use of coloring gases. What could be simpler than putting green fruit in room, introducing some gas and a few days later removing the fruit fully colored? If a room wasn't handy a canvas covering served the purpose. But coloring fruit without stimulating decay turned out to be a different and complicated problem. The decay factor became so great that it completely overshadowed the less apparent complications, and as things now stand we are a long way from a practical solution of many of our coloring problems.

While it is true that marked progress has been made in coloring operations it is also true that much remains to be learned before definite, dependable recommendations can be made regarding the optimum conditions that should obtain during the coloring period. There is ample evidence proving that the old coloring rooms did not afford a healthful environment for the fruit.

The first coloring rooms were loosely constructed with large cracks in the floor and knot holes in the side walls and ceiling. These openings afforded fair ventilation although little thought was given to that phase of the problem in those days. During warm weather fruit colored fairly satisfactorily in such rooms but in cool weather color developed slowly because of the low temperatures.

Soon it became obvious that in order to color fruit in cool weather, roughly between the middle of October and the first of May, some changes must be made in those rooms. The first step was to make the rooms almost air tight and heating units of one kind or another were installed. Right then and there our troubles began, principally in the form of decay. The fruit colored all right wherever the radiators were placed in desirable locations, but there were some rooms with radiators attached to the ceiling and naturally they were not efficient. As much as a forty degree spread in temperature between top and bottom fruit occurred in such rooms. The bottom fruit was slow in coloring if it colored at all; the top fruit was often injured by its environment. Radiators placed under a false floor were much more efficient.

Then came a further improvement by placing one or two small fans of low efficiency on the ceiling and directing the air blast downwards in an attempt to equalize temperatures. This helped somewhat but it fell far short of producing the desired results. Decay continued to be the most serious problem in connection with coloring.

During all this time we were making our rooms more and more air tight. We ignored the fact that fruit is a living organism, that it requires fresh air in considerable quantities, that it gives off gases that appear to be toxic to itself, that the higher the fruit temperature the greater demand by the fruit for fresh air. In effect we were doing about all we could to create a set of conditions which would cause the fruit to develop a bad case of auto-intoxication sometimes permanently affecting the flavor and often rendering the fruit subject to rapid spoilage.

Some three or four years ago, during the early part of the shipping season, a severe outbreak of decay developed in colored fruit shipped from certain localities. An investigation revealed the fact that in some cases the coloring rooms were so tightly constructed that from three to four and even five per cent waste gas (CO_2) was found in them during the coloring period. We, ourselves, couldn't stand such an environment, yet we expected the fruit to enjoy it. In other rooms, with porous side walls, considerably less stale gas was found, and considerably less decay developed on fruit colored in them.

From this developed the construction of coloring rooms with porous side walls and ceilings and also the practice of opening the coloring room doors for thirty minutes or more every few hours for the purpose of driving out the foul gasses. This practice proved to be a milestone in the progress toward better coloring methods, as it greatly reduced the rate of decay and paved the way for a better general understanding of the fruit's requirements. The weak point in this practice was that in cold weather the fruit would become chilled and thereby coloration was retarded.

This brings us up to 1929 when it became necessary to build sterilizing rooms in many of the packing houses. The better types of these sterilizing rooms made excellent coloring rooms. They were equipped with adequate heating, humidifying and air circulating facilities as well as with a ventilating feature which permitted of the introduction of an abundant supply of fresh air continuously. With such equipment the fruit could be cooled quickly in hot weather, or warmed to the coloring temperature in a short time even in the coldest weather. In fact almost any reasonable air condition could be had in these rooms regardless of the weather. Fruit could be colored in these rooms quickly, uniformly and with no great flare up of decay, but other undesirable symptoms of distress, such as rind pitting, continue to develop on some varieties.

The so-called gas scald, or pits, that develop on the rind of certain varieties continue to give considerable trouble. A fruit may appear perfectly sound when it is removed from the coloring rooms but these rind pits, one-fourth inch or more in diameter, slightly sunken and of a brownish color may develop before the fruit arrives at market. The pineapple and ruby blood

varieties appear quite susceptible, while the Valencia and other popular varieties are not immune. The coloring gasses seem to play little or no part in the causation of this blemish, although coloring room environment seems to aggravate it. The underlying cause or causes of this blemish are unknown, however some shippers believe this trouble originates in the grove.

That the packinghouse manager inherits some of his troubles from the grower is undeniable. The grower who attempts to increase his production beyond a safe limit is likely to produce a crop of coarse fruit that responds to coloring gasses slowly, if at all. The injudicious use of stimulating fertilizers often results in a coarse fruit that is difficult to color, necessitating prolonged exposures to gas. This is especially true of fruit that is "regreening" in the spring. The so called "hot shots" or supplementary applications of ammoniates sometimes applied in early fall in an attempt to increase the size of the fruit usually accomplishes that purpose but they also coarsen the fruit and usually renders it resistant to the action of coloring gases and apparently increases its suceptibility to green spotting of fruit picked during the fore part of the shipping season.

Fruit that has been sprayed with oil within a few weeks or months (depending upon the type of oil) is exceedingly difficult to color, and it is rare indeed that such fruit takes on a uniform color, rather it is more likely to develop a splotched appearance even after prolonged exposure to gas.

Speaking of gases it has long been believed by growers and shippers alike that fruit colored with ethylene decayed more rapidly than that colored with kerosene fumes. Such beliefs were well founded and the natural conclusion was that ethylene itself stimulated rots. As a general rule ethylene was applied under one set of conditions and kerosene under another, however this point was not considered to be significant. During the past year or two commercial practices in up-to-date coloring rooms have pretty well established the conviction that under similar conditions with respect to adequate ventilation, air circulation, etc. fruit treated with ethylene colors as quickly and appears to keep as well as that colored with kerosene fumes. The sum total of the practical advantages heretofore in favor of kerosene fumes, now appear to be somewhat in favor of ethylene provided the fruit is colored in modern coloring rooms.

The next and final real problem to be mentioned at this time is dispatch in getting fruit from the tree, through the packing house into the precooler or iced car. Both early in the fall and late in the spring when fruit is difficult to color, when weather conditions are favorable for rapid development of stem end rot, and when the packing house is running only part time, there is a tendency to let fruit remain on the floor several days longer than is necessary. This almost always results in a heavy decay report from the market, and we have no one to blame but ourselves. If on the other hand no time is lost in getting the fruit from the tree, through the coloring room into the iced car the element of decay of colored fruit is greatly reduced, if not eliminated.

Fruit can now be quickly precooled in the car by the use of a portable blower developed by our office. This precooling equipment is inexpensive, it is a success, and it fills the needs at packing houses when the volume of fruit packed does not justify the installation of permanent precooling rooms, etc. Quick chilling of fruit, especially fruit that has been colored, or for other reasons held in the house a day or more, is an essential step during warm weather if we don't want to pay for a lot of decay.

ROTS OF FLORIDA CITRUS FRUITS

By H. E. Stevens and H. R. Fulton, Bureau of Plant Industry, U. S. D. A., Orlando, Fla.

There are two general classes of decay in Florida citrus fruits that may impose a heavy tax on the season's crop. These are the Penicillium rots and the stem-end decays. Under the Penicillium rots we have the blue-green and olive-green molds, commonly termed blue molds, familiar and long known troubles in all countries where citrus is produced or offered for sale.

The stem-end rots are a very different type and much more difficult to handle. They attack and break down the inner tissue, causing a rotted fruit that is evident only after a period of time. Apparently sound, healthy fruits are packed and sent on their way to distribution only to arrive in a state of decay, or perhaps later develop decay on the fruit stand and in the household of the consumer. Decay of any kind in fruit is a poor advertisement all along the line, from the shipper, wholesaler, retailer to the ultimate consumer, and it is on the consumer that the success of the industry depends. If he is unfavorably impressed by decay, inferior quality, or poor appearance, this is reflected in the sale volume and price of the product as citrus growers are well aware.

The grower, the packer, the shipper and the buyer are all equally concerned in the problem of decay and each may do his part in keeping it down to the lowest point consistent with economical practices.

CAUSES OF DECAY

The rots or decays are caused by small organisms known as fungi. These are microscopic plants that invade and grow in the tissue of mature fruits. Some can attack and destroy apparently sound, healthy fruits. The stem-end rots of citrus fruits are typical examples. Others are wound parasites and require a break in the outer surface of the fruit in order to enter and cause decay. This happens in the case of blue mold rots. Fruits affected by either of these types of decay are not fit for consumption and become a total loss. The consumer will not buy decayed oranges or grapefruit at any price, and he hesitates to purchase fruits that might be susceptible to decay or that have a reputation for poor keeping quality.

The fungi that cause these decays are widely distributed in the Florida citrus groves. They will remain as long as our citrus trees continue to grow and must be accepted as something to be reckoned with in the production of each season's crop. These small plants grow and reproduce just as truly as do our large visible plants. Their minute reproductive bodies or spores are carried about in the air, and in suitable lodging places find congenial conditions for growth and further production of spores. The cycle is thus continued, probably many times during the season, and an abundance of infectious material is usually present to cause trouble if favorable conditions arise, whether it is in the grove, packing house, storage or anywhere that fruit is handled.

During the past twenty-five or thirty years a large amount of attention and study has been given to citrus rots and their control by workers in the United States Department of Agriculture and State Experiment Stations, with a view to finding weak points in the cycles of development of these fungi, and practical methods of rot control. Sufficient information is available in publications of these institutions to materially reduce the decay that occurs each season. Conditions that favor or induce rots should be given the same consideration and study that is given to the care of the citrus grove and the use of various measures to produce the crop.

The grower or shipper with a carload of citrus fruit in any of our leading markets showing ten per cent to fifteen per cent decay can do nothing to remedy the immediate situation. He will be forced to take his loss. The time to prevent such a conditoin is perhaps before the fruit is matured or when it is picked or at least at the time of packing. It is well to bear in mind that a certain amount of decay, small or large, is apt to occur each season but this amount may be reduced

if timely precautions and effort are put forth to avoid it.

It is too late to attempt to save a fruit after decay has started. Preventive or precautionary measures must be taken well in advance of the trouble.

CONDITION OF FLORIDA CITRUS FRUIT ON ARRIVAL IN THE MARKETS

A summary is given in Table 1 of Federal inspections by the Food Products Inspection Service of the United States Department of Agriculture on all Florida citrus shipments arriving at the Cleveland market through April* of the current season. Over ninety per cent of the arrivals were in time for auction on the morning of the fifth day after leaving the packing house. It is assumed that this tabulation gives a fair indication of the average condition of the bulk of the Florida crop for the 1930-31 season. It will be noted that grapefruit arrived in best condition, tangerines in worst, with oranges intermediate. If two per cent is taken as a reasonable tolerance for rot on arrival, grapefruit shows eighty-nine per cent, oranges eighty-three per cent, tangerines eighty per cent, and all citrus eighty-five per cent arriving in satisfactory condition, leaving eleven per cent, seventeen per cent, twenty per cent and fifteen per cent, respectively in the unsatisfactory class. For a tolerance of three per cent it may be estimated from the table that about six per cent of grapefruit, eleven per cent of orange, fourteen per cent of tangerine and ten per cent of all citrus shipments would fall short of requirement.

*Data for March and April compiled after presentation of paper.

TABLE 1.—Condition of citrus fruit on arrival at Cleveland, Ohio. Number of cars per 100 showing various amounts of decay. Based on Federal inspections, September, 1930—April, 1931.

	Non-cumulative				Cumulative				
	Grapefruit	Orange	Tangerine	All Citrus		Grapefruit	Orange	Tangerine	All Citrus
Total Records	630	468	199	1297	Total Records	630	468	199	1297
No rot	56.1	26.7	10.0	38.4	No rot	56.1	26.7	10.0	38.4
½ to 1% rot	22.2	38.7	47.3	32.0	Not over 1%	78.3	65.4	57.3	70.4
1½ to 2% rot	10.6	17.1	22.2	14.7	Not over 2%	88.9	82.5	79.5	85.1
3 to 4% rot	5.7	9.6	10.5	7.8	Not over 4%	94.6	92.1	90.0	92.9
5 to 8% rot	4.1	5.5	7.0	5.1	Not over 8%	98.7	97.6	97.0	98.0
9 to 16% rot	1.0	1.1	1.5	1.1	Not over 16%	99.7	98.7	98.5	99.1
17 to 32% rot	0.3	0.9	1.5	0.7	Not over 32%	100.0	99.6	100.0	99.8
33% and up	0	0.4	0	0.2	All	100.0	100.0	100.0	100.0

Everyone knows that rot lowers selling prices. In order to figure how much can reasonably be spent in an effort to control rot, one must have an idea about the degree of lowering as well as the amount of rot that can be expected on the average. Several years ago an effort was made to get price figures to show to what extent various amounts of rot showing up in shipments of oranges influenced the auction prices for 200 size golden grade. Table two gives the results for two seasons on the Philadelphia auction and one season on the Chicago auction, with an average for the three seasons in question. If we assume that these orange price discounts on account of rot would hold for the current season and for all varieties, grades and sizes of citrus, and if we assume further that the Cleveland inspections are a fair average for the whole Florida crop, we can figure out that the total loss on account of rot would amount to about $32 on every $1,000 or 3.2 per cent of sales at terminal markets. This would be about $1,600,00 on a crop selling for $50,000,000. Rightly directed and timely effort ought to save at least one-half of this loss. Note

in Table two that the average discount per $1.00 selling price is very close to twice the upper percentage of rot for each group, indicating that the buyer takes off as much for further expected rot development as for what is already showing up as maximum for the group range.

TABLE 2.—Effect of various amounts of rot on selling price.

	Index prices, Oranges				Theoretical showing for 1930-31				
	Philadelphia		Chicago	Avg.	Discount per $1 Selling Price	Boxes per 1000	Loss per $1000 sales	Boxes per 1000	Loss per $1000 sales
Amount of rot	1924-5	1925-6	1926-7	3 years					
0 to 1 %	$1.00	$1.00	$1.00	$1.00	0	654	0	705	0
1½ to 2%	1.05	.94	.91	.96	$ .04	171	$6.84	148	$5.92
3 to 4%	.97	.95	.83	.92	.08	96	7.68	79	6.32
5 to 8%	.84	.86	.82	.84	.16	55	8.80	51	8.16
9 to 16%	.69	.75	.47	.64	.36	11	3.96	18	6.48
17 to 32%	.58	.49	.39	.49	.51	9	4.59	7	3.57
33% and up	—	.26	—	.26	.74	4	2.96	2	1.48
					Equivalent to		3.5%		3.2%
					Total loss per $1000		$34.83		$31.93

The relative frequency of stem-end rot and blue mold rot is shown month by month in Table 3, which has been compiled from all Federal inspection reports of rot occurring in Florida citrus on arrival at consuming markets, October 1930—April 1931. These reports naturally present a worse than average picture of rot conditions, since many of them were requested because the fruit showed excessive decay or other trouble.

It is seen that stem-end rot is responsible for about ninety-eight per cent of the rot reports for September and October, for sixty-seven per cent of those for November, dropping to eleven per cent in December, and then below four per cent for each of the next three months, with a slight rise to six per cent for April. It is a warm weather trouble. Blue mold rot was responsible for ninety to ninety-eight per cent of the reported cases for the cooler months when the heaviest shipments are made.

TABLE 3.—Percentage comparison of Stem End Rot and Blue Mold Rot Reports by Months, 1930-31. Federal inspections of Florida citrus on arrival at consuming markets.

	Sept.-Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.	
Amount of rot	S.E.R.	B.M.R.	S.E.R.	B.M.R.	S.E.R.	B.M.R.	S.E.R.	B.M.R.	S.E.R.	B.M.R.	S.E.R.	B.M.R.	S.E.R.	B.M.R.
½ to 1%	33.3	2.2	26.4	17.7	5.0	37.3	2.2	38.9	2.5	26.5	0	29.2	0.4	18.1
1½ to 2%	15.1	0	9.4	6.5	3.3	23.0	0.7	30.9	0	26.5	0.6	27.6	1.3	22.4
3 to 4%	10.7	0	8.8	4.1	1.1	12.1	0	14.7	0	14.0	0.6	24.2	1.7	20.2
5 to 8%	12.9	0	10.6	2.9	1.1	11.0	0.7	8.8	0	20.0	0	10.0	1.7	19.1
9 to 16%	12.9	0	6.5	0.6	0	2.7	0	2.9	0	8.5	0.6	5.5	0.9	11.2
17 to 32%	10.8	0	5.3	1.2	0.6	2.3	0	0	0	1.0	0	1.1	0	1.7
33% up	2.2	0	0	0	0	0.6	0	0	0	1.0	0	0.6	0	1.3
Total	97.8	2.2	67.0	33.0	11.1	88.9	3.6	96.4	2.5	97.5	1.8	98.2	6.0	94.0
Reports	93		170		182		136		200		181		218	

BLUE MOLD

The Penicillium rots are too well known and easily recognized to need any detailed description. They produce powdery masses of blue-green or olive-green spores on the surface of the infected fruits. Such fruits may be found hanging in the trees or on the ground beneath the trees, in the packing houses, in packed containers during shipment or while held in storage, on the fruit stands, or in the homes of consumers. The tiny spores are blown about by the wind like dust, and one fully decayed fruit can produce enough spores to thoroughly contaminate a soaking tank and other packing house equipment. During our picking and packing season there are frequently periods when oranges and grapefruits are exposed to clouds of Penicillium spores in the open groves. They are further exposed to contact with spores in passing through the packing house, and in all stages of marketing. So long as there is no break in the rind of the fruit there will be no decay from these spores. The Penicillium fungi are unable to penetrate the unbroken rind of healthy citrus fruits. It is through relatively fresh thorn pricks, insect punctures, clipper cuts, scratches, bruises and mechanical injuries due to rough handling that they gain entrance to mature citrus fruits and set up decay.

The Penicillium rots are less difficult to control than other citrus decays if a few proper precautions are observed. They are greatly influenced by temperature and moisture. During warm dry weather these molds give very little trouble and no unusual precautions may be necessary.

For this reason we have very little of the Penicillium rots during the first part of the shipping season. As the weather becomes cooler and especially under moist conditions these rots increase very rapidly and a spore menace is soon produced.

CONTROL MEASURES

(1) *Careful Handling.* This is the first requirement in blue mold control and the one that is most often violated. The fruit should be carefully handled from the time it is picked until it reaches the packed container for it is during this period that it is most exposed and most liable to infection.

Clipper cuts, rough handling and mechanical injuries that may be caused by the packing machinery should be strictly avoided. This is particularly true when Penicillium rots are numerous in the groves or weather conditions are favorable for their development. There is little of practical application that can be advised for freeing the groves of these rots, other than the control of pumpkin bugs or other puncturing insects that sometimes infest the groves and aid materially in the increase of these rots. Packinghouses, trucks, cull bins and containers in which fruit is handled should be kept as free as possible from Penicillium rots and the spores of these fungi. Under certain conditions during periods of considerable decay, thorough disinfection of the premises may be necessary at frequent intervals. Rotten fruit should be kept out of soaking tanks and washers. All equipment should be thoroughly examined for any possible cause of mechanical injury to the fruit.

(2) *Chemical Treatments.* In periods of blue mold rots the fruit is often treated with some chemical to kill any surface spores. Various chemicals and solutions have been used and they have their disadvantages as well as their advantages. Such treatments may be applied in the soaking tank or just as the fruit comes from the washers. If the rind of the fruit is sound and unbroken it will not need any chemical treatment to protect it from the blue mold rots. If the fruits has been roughly handled and the conditions for rot development are favorable, the use of a chemical treatment may prevent a considerable proportion of the rot. A mixture of borax and boric acid, in five per cent strength is quite effective.

(3) *Drying.* The fruit should be quickly and thoroughly dried after it comes from the washer. Moisture is necessary for the germination and growth of the Penicillium spores, and even small amounts left on the surface of fruits may be sufficient to start activity. If the fruit is packed while moist, ideal conditions are provided for spore germination, and injured fruit will be more or less likely to develop decay. Sweating of the fruit on sudden removal from cool to warm conditions favors germination of spores and infection.

(4) *Refrigeration.* Lowering the temperature below 50° F. retards but does not prevent the development of blue mold rot. The sooner the fruit is chilled, as by precooling, the more satisfactory the results.

STEM-END ROTS

The stem-end rots present a more difficult problem to handle. They are caused by either of two fungi, Phomopsis or Diplodia, very different organisms from those of the blue mold group. Both types of stem-end rot are similar in general appearance, and it is not possible to distinguish one from the other through the examination of the outer surface. There are some differences, however, in seasonal occurrence, reactions to temperature and rapidity of development.

Stem-end rot begins with a soft spot at the stem-end of the fruit, hardly noticeable at first. It is at this point that the fungus enters, either through the woody stem or appendages of the button. Beginning stages may show no discoloration, but as the rot progresses the affected area of the fruit becomes brown or coffee colored. There is no surface growth of the fungus on the fruits until after they have shrivelled and mummified. Spore production does not occur, or rarely so, on affected fruits.

The fungi causing both of these rots grow and produce their spores in the dead bark of citrus twigs and branches. The spores are borne in globular receptacles buried deep in the bark. When the spores are mature, if the bark becomes wet, these receptacles swell, protrude through (and beyond) the bark and exude the spore masses often in thread-like tendrils. The wind and rains scatter the spores through the trees and those coming in contact with the fruit, under favorable conditions start on their work of decay.

The dead wood in citrus trees is the immediate source of stem-end rot, but the development and progress of the decay is largely influenced by moisture and temperature conditions. Warm, rainy weather is a favorable condition for initial infection, much of which occurs before the fruit has matured.

The Diplodia stem-end rot usually occurs in the early shipping season and it will often develop very quickly during periods of warm weather. At temperatures between 90° and 95°F. the fungus is most active, causing complete decay of fruit in two or three days after the first indication of rot. Diplodia stem-end rot has given considerable trouble in the coloring rooms during the past few seasons, especially where temperatures were allowed to run high and the ventilation was poor and excessive dosages of gas were given. Excessive rot under such conditions often occurs and it may run from ten per cent to forty per cent following a seventy-two hour coloring period. As the weather becomes cooler the Diplodia rot shows a tendency to decrease; however, a certain per cent continues throughout the season.

The Phomopsis stem-end rot develops at a somewhat lower range of temperatures than Diplodia, and may be expected to show up during periods intermediate between the warmer and cooler parts of the shipping season. It too is increased by improper coloring room methods.

CONTROL

The control of citrus stem-end rots will require the co-operation of all parties concerned in handling the fruit. The grower has his responsibility. Since dead twigs and branches are a source for infectious material the citrus tree should be kept reasonably free from dead wood and all agencies that tend to cause dead wood.

(1) *Removal of dead wood.* A certain amount of pruning out of dead wood should be done from time to time. This reduces Diplodia stem-end rot considerably, but can not be relied upon for complete control. Scale and other insects are responsible for large amounts of dead wood, also lack of plant food, drought and flood conditions, and these should be taken care of at proper seasons. Any practice that has a tendency to weaken the trees should pe avoided, for weakened trees generally accumulate the largest amounts of dead wood. The older bearing groves will be more subject to stem-end rot than younger groves owing to the accumulation of dead wood.

(2) Special spraying for the control of stem-end rot alone will hardly warrant the effort or expense. It has been found, however, that an application of 3-3-50 Bordeaux mixture applied for melanose control in late April or early May

has given a considerable degree of protection against Phomopsis stem-end rot.

(3) *Care in coloring.* Use fruit on which the color has broken so as not to require prolonged coloring-room treatment. This is especially important for fruit from trees with considerable dead wood, or for other reason suspected of being subject to stem-end rot. Do not let coloring room temperatures go much above 85°F. Provide for adequate ventilation. Avoid excessive dosages of ethylene or stove gas.

(4) *Chemical treatment.* The solution of borax and boric acid used for blue mold control will reduce stem-end rot.

(5) *Refrigeration.* Since the temperature range is relatively high for both forms of stem-end rot, lowering of the temperature below 55°F. is a very effective means of control. This should be promptly done, especially with fruit that has been through warm coloring rooms. Pre-cooling is very desirable in such case. Dealers and consumers should keep the fruit in cool places.

(6) *Prompt handling.* During warm weather, when stem-end rots prevail, it is important to move the fruit as promptly as possible to market and through distributing channels to final consumption. Both stem-end rots are rather slow in developing their full effect at average daily temperatures at northern markets during even the warmer portions of the Florida shipping season. If not subjected to coloring room incubation or to the sometimes tardy handling at the start of the packing season, much of the loss from stem-end rot will be avoided simply by hastening consumption of the fruit.

CO-OPERATIVE TRAITS IN CITRUS WORK

J. C. Morton, Auburndale.

Its three years, three short years, since I had the opportunity and privilege of addressing the Horticultural Society. Then the Clearing House idea in citrus Florida was just being broached to the people of the State, and it was my opportunity then to seek to advocate to you the formation of the Florida Citrus Growers Clearing House Association. At that time, it seemed doubtful whether the idea would go over, but it has been successful, and the Clearing House is now coming to the close of its third year of effort in the aiding of the marketing of the Florida Citrus crop.

A colored gentleman recently looked very sad in the morning, and his master seeing him said "Rastus, why are you so down-hearted this morning?" Rastus says "I will tell you, Boss, somebody done let my chickens out last night." Well, his master said "Don't worry about that; don't you know chickens go home to roost?" Rastus says "That's just what I is worrying about, they'se done gone home," and I want to say to you that in the last three years, since the formation of the Clearing House, there has gone home to the mind of every citrus grower in the State of Florida the idea of co-operation. We have abandoned the old thought that each one lives for himself. We have abandoned the idea that the citrus industry belongs to us, as individuals, and we are now learning to sacrifice personal individual interest for the need of the whole. We are now learning to understand that the needs and purposes of the industry are our individual needs and purposes, and so we are standing shoulder to shoulder today more than we ever have done before.

I want to state to you that I stand shoulder to shoulder with every citrus grower in the State of Florida. I rub shoulders with every other grower, whether I know him or not, and nothing I do in my grove in the way of production but what effects every citrus grower in the State; nothing I do with my fruit, toward the marketing of it, but what effects every other grower. Let me make that clear. If in my grove production I produce better fruit than I did a year ago,

it is reflected in the reputation of Florida's fruit throughout the markets of the country, and because of that it benefits every citrus grower in the State. On the contrary, if I permit myself to produce poor quality fruit, and permit immature fruit from my grove to be shipped, I ruin the reputation of our Florida fruit, and damage every citrus grower in the State. So it is, too, that if I seek to market my crop without consideration for the crops of the others, I do a serious damage to every citrus grower in the State of Florida, but if I realize that the marketing of the Florida citrus crop is not my personal problem, but the industry's problem, and join in with the industry in an orderly distribution of the crop, I have benefited the citrus industry and helped my neighbor growers in helping myself.

The Florida Citrus Growers Clearing House was organized for three primary purposes—to accomplish three main objects:

1. The Standardization of the product. That has been splendidly done. I don't want to tell you that the standardization of Florida citrus fruit has yet been made perfect, but in the last three years we have made wonderful strides, and I believe the standardization program that we established three years ago in the Clearing House is at least responsible for the success the Florida citrus growers are having today over our neighbor growers in the State of California.

2. Then again, we joined, in the Clearing House, to do a national advertising program, making every box of fruit in the State of Florida, as far as possible, bear its share of advertising Florida citrus fruit. For two years, that was done in a small way, but last year in still a smaller way, because we abandoned the advertising assessment. As a grower, I am going to plead with you that again we go back and advertise Florida citrus fruit as a group, rather than seek to advertise Florida citrus fruit as particular divided groups; because a Florida orange, or a Florida grapefruit is a Florida product, a produce of Florida sunshine, and summer breezes, whether it is in one box with one type of label, or packed in another box with another type of label; and no Florida fruit should be placed in competition with any other Florida fruit in the markets of the country, but every orange, and every grapefruit in the State should bear its burden of an advertising program that would make known to the world that Florida fruit is superior to fruit grown in any other part of this great land of ours.

I am hopeful that some day soon we will go back to our original idea of advertising Florida fruit as a unit throughout the Clearing House, and then let advertising build itself up on that ground.

3. The third object was the distribution of the crop. I don't mean to claim to you folks that it has been a great success, but I do know that through the Clearing House we have accomplished wider distribution, and more orderly distribution than has even been known before. I am going to make a striking statement—some of you may not agree with it—but I want to say this, that in spite of the tremenduous problem, in spite of the fact that there has been red ink sent back from some of your fruit shipped, in spite of the fact that I myself have received some of that red ink, I make the bold assertion that this has been the most successful marketing effort that has ever been made in citrus Florida.

We are shipping this season from the State of Florida not less than thirty million boxes of fruit— our first thirty million box crop, and we are shipping it against a tremenduous crop from the sister state of California, and shipping it against a depression throughout the country, the like of which has never been known in the United States before. And in spite of all that we have made a more successful job, a more profitable job of marketing this season's crop than any other crop that ever left the State and it has been largely due to the united effort we have made through the Florida Citrus Growers Clearing House Association, in that we are learning co-operation. I don't mean to say the Clearing House is the ultimate. I believe in co-operative marketing. I believe the day is coming where under economical methods and efficient management, co-operative marketing will control the greater proportion of the Florida citrus crop, but I do hope that there shall never be a time in the State of Florida when the organization shall control all of Florida's citrus, because I believe in the healthfulness of competition.

I believe that today we folks in Florida, as well as throughout the world, are getting purer ice, better ice, and better service because of the competition of the electric refrigerating plant prepared for the home, and I believe that the citrus growers of the State of Florida will receive better returns, better marketing effort, wider distribution and keener and more economical packing and distribution of products because of some competition throughout the marketing organizations of the State, and I am hopeful that the day is not far distant when instead of 140 marketing organizations of citrus over the State of Florida these shall be united into a few small organizations, and efficiency in marketing will be introduced in the citrus industry.

We are facing the question of the survival of the fittest. I am not discouraged about the Florida citrus industry. Mr. Norman Vissering spoke to you about lowering costs in citrus production, and there are two ways in which citrus profits may be increased—first of all, by lowering the costs of production, and secondly, by lowering the cost between the grove and the consumer, and this year we have seen wonderful changes in the marketing of the Florida citrus crop. I believe at least thirty per cent of the crop has left the State in bulk this year, which has lowered the cost of packing and all the nails, straps, paper, boxes, and so on, resulting in getting the fruit to the consumer at a less cost than by the old method. Then there are trucks—hundreds of them—hauling fruit from Florida every day, some going as far north as the State of Michigan. That is bringing new sections into the citrus industry, and giving us wider distribution, and carrying the fruit to the consumer at less cost than ever before.

These are new things coming into the citrus industry. They present new problems. Today, we don't know how much fruit is left in this State, and we shall not know what the size of this crop has been because of the tremenduous truck movement gone out of the State this year, and because of the volume moved by truck, because of this new evolution, there is greater need than ever before for unity among the growers and shippers.

These things are presenting new problems that never existed before, and these can only be solved by the growers uniting together in the Florida Citrus Growers Clearing House Association in order to so control distribution by truck and otherwise that we may know what we are doing and market the Florida citrus crop intelligently, because the crops from year to year will be larger and there will be greater need of unity.

I am just going to talk on two of the main accomplishments of the Clearing House. Forgetting these accomplishments in advertising, in standardization and the splendid accomplishments in distribution and control, let me speak of this wonderful accomplishment during that dread period when we were threatened by the Mediterranean Fruit Fly. United as we were in Florida Citrus Growers Clearing House Association, we were enabled in that united effort to gain relief from the strangling quarantines in a way we could not have done had we been divided as we were prior to the Clearing House coming into existence; and then this year we made a wonderful accomplishment in uniting with the American Fruit Growers as no other organization could have united, but dangling together in the Clearing House Union we united with the American Fruit Growers and backed them up, enabling them to kill that splendid eflort in the Supreme Court of the United States, which freed the citrus industry from the tax on borax.

As the years go by, there will continue to be problems, and these can only be solved by united effort, and the only organization in the State today big enough to do the things that need to be done is the Florida Citrus Growers Clearing House Association, and I am happy again to present it to you at this time, not as something that has to be delivered, and lies in the future, but as something that has lived and worked, and has three years of splendid accomplishment behind it that recommends it to every citrus grower in the State.

GRAPEFRUIT DISTRIBUTION

By Mark Hyde, Refrigeration Engineer, Jacksonville, Fla.

Analysis of New York auction sales for the current season to date show average returns on grapefruit to approximate $2.35 a box. Out of this the shipper is debited:

Picking and Packing	$ .70
Freight	.96
Selling	.25
Total	$1.91

That leaves forty-four cents for producing a fruit costing the most efficient grower thirty cents, and the average fifty cents. When we consider that only the cream of the crop goes to New York, and much of that must carry icing charges, that other auctions with higher freight rates fall below the New York average, and that canners have hammered their basis to thirty cents; the outlook appears most distressing, and we may well ask—"Watchman, what of the Night?"

Are we hopelessly headed for over-production? The promised increase from new growth threatens further overloading of an already burdensome domestic situation. Texas, with five and one half million trees, the same as Florida, and with practically none yet in full bearing, threatens our mid-west trade. Canning reduces fresh fruit consumption, or at least prohibits its growth in almost exact ratio to its own growth. For thirty years there has been no increase in the per capita consumption of fresh fruits. It was 162 pounds in 1899 and averaged the last three years 166 pounds. All our diet propaganda, and "eat more fruit" advertising has accomplished is to increase the consumption of processed fruit from seven to twenty-six pounds per capita.

The advertisement that tempts trying a grapefruit tempts dropping an apple—for we certainly cannot eat both.

Unfortunately the meat or juice from a disfigured, negligently cultivated fruit that would grade a No. 3, or cull, cannot be told in the can from a No. 1, and the discouraged grower forced to sell at thirty cents lets his grove slide.

Bulk movement adds further to his discouragement, for gone are the days when packing profits absorbed growing losses. Both living and distribution standards have changed to where the housewife prefers pulling her car up alongside a peddler's truck and having a bushel, or part thereof, of grove-run fruit, less by-product sizes, dumped in the tonneau. Price is more important than grade.

Chain stores have always been antagonistic to wooden boxes, and welcome the new era. Boxes and wrappers both are a nuisance in retail distribution. Buyers will not buy sight unseen, and chain stores have neither the man power to waste in unwrapping, nor the space to waste in storing a bulky rubbish that adds the further burden of cost for removal. Chains now know bulk shipments stand up better than package; and their only hope of meeting truck peddler competition is through bulk car delivery and packaging direct from car to mesh sacks or some other visible container.

The apple grower solved his problem by cultivating a fruit that would stand storage from growing season to growing season, and thus extended distribution from a few months to twelve. The poultry man did the same with eggs; and so may Florida with citrus.

Florida's problem is not now, nor does it promise to be in my opinion, over-production, but under-distribution. Her crop is distributed through the winter and spring months, when both domestic and export centers are so cold grapefruit has small place on their menus. One summer month in any of the major states or in Europe will absorb as much grapefruit and at better prices than two winter or spring months.

The immediate future threatens crops twice as great as can profitably be marketed under present methods of distribution. Our season runs from December to May inclusive, with a little "too

green to eat" fruit in November and a little "too ripe to eat" in June. June, July and August are worth as a market the whole six, but they cannot be won with over-mature, over-size, tree-scarred fruit such as is certain to result when the tree itself is used for storage. Nor can the tree stand such a double duty and bear good fruit the next season.

If grapefruit can be picked before April and held for a summer outlet that industry faces a new lease of life. Can it? Yes, if the grower, packer and refrigeration engineer do their part.

From the biological viewpoint the life of a fruit destined for long storage is dependent on three variables—racial characteristics of the mother tree, culture of the mother in preparation for the blossom and on through to harvest, and picking, packing and holding.

You will note all come under the control of one of the three interests specified.

Before going further it is but fair I give credit for much of what I am about to tell you to Drs. Kidd, West and Griffiths of Cambridge University and to Dr. Thompson of Liverpool University. These men I consider the greatest authorities living on citrus, and many of my own experiments owe their success to the fact I've followed their work for the past ten years, as well as visited their laboratories and research stations. England lives on what she imports, and taking a box of grapefruit from Florida, for example, that costs 50 cents to grow, the added cost for sale on a London or Liverpool auction will be $2.80. That makes it essential waste be kept a minimum, and English research has been carried out in the growing, packing and distribution fields to an extent never approached in this country.

Influence of race and culture are most important. All trees are reproduced by seed or by graft from one original. Every individual that arises from a seed is apt to be distinct from every other. where grafts from one original are that same original in every characteristic, and if the original is known to be hardy, results are certain. This suggests the desirability of selection and breeding to produce long holding fruit.

When asked last week to watch the gas storage tests at Howey in the Hills, my first check was on the mother trees. They were grafts from the famous Bryson grove at Winter Haven, and their cultivation had been nigh perfect. Here was a splendid example of the grower doing his part.

As bankers, the Farm Board, or some interest will have to finance fruit held for summer sale; it is obvious they must have an assurance it came from stock that can be relied on. "Who was the mother" would be the first question of any intelligent lender.

The culture of trees to bear long storage fruit calls for grave consideration of the merits of fertilization by means of bacteria cultures in humus, in addition to the chemical fertilizers now in use. Many growers are prone to use too much ammonia; and to forget good keeping fruit is correlated with sufficient available potash and phosphoric acid, and the absence of too much nitrogen. Cover crops, and the advisability of molesting them as little as possible are another factor for consideration. No relation appears to exist between the weather during growing and storage life of fruit; but as a rule the more sunshine the more vitality. Too great stress cannot be laid on the need of keeping drops off the ground. They are foul with fungi after twenty-four hours, and a menace to the life of every fruit in the grove. Pick them daily, not weekly or never, if you want fruit to hold. Stem-end rot is probably the worst enemy of all and only by prompt removal of infected wood and by thorough spraying can the grower fully do his part here. Pruning as well as fertilizing very definitely affects hardness.

Harvesting is as important as culture. Good keeping is associated with clear, dry weather during picking. Fruit should be picked while immature to the extent of showing a tinge of green about the button. The younger the tissue the better able the fruit to survive long holds at low temperatures. Have you not noticed how often the tip of a leaf shows cold damage where the younger base shows none; or how of two fruit on the same tree of different blooms the earlier shows greatest cold damage?

Green on citrus invariably denotes dormancy. There are two causes for this—withholding or removal of water and exposure to low temperature. This is another good reason for picking in the

cooler months. Even then care is needed to pick from resting branches as opposed to active, and both may be found on the same tree.

There is a temptation to defer picking on the assumption the bigger fruit grows the more boxes the tree produces and the less the storage charges. The combined loss from drops and storage breakdown of too mature fruit will offset this gain every time, and eventually ruin the reputation of brands made up of such fruit with both lenders and buyers. Another point, all fruit destined for export must be picked while of suitable size; eighty's and smaller, and in many seasons, such as the present, may have to be in storage by March.

In packing, all fruit should first be checked for rots to avoid fouling soak-tanks and other equipment handling sound fruit. It should then receive a thorough bath in borax to insure protection from the Blue and Green molds, and speaking of molds, I want to stress the need of protecting all crate material from such contamination. Wood assembled for this purpose during the off season in dirty packing plants, and there are many of them you could not sterilize at any cost, is also rife with fungi, and the least rise in humidity or formation of condensation encourages a rapid growth over the entire box. Crate material should always be stored in a sterilized shed and conveyed to the packing house for immediate use only.

Inability to properly dry the washed fruit is another cause of storage break-down and I've seen few efficient dryers in Florida. After drying the fruit should be sprayed with parafine. This treatment materially retards respiration, and protects against withering with no damage to the rind; as it does not penetrate into the pores. Parafine hardens and forms a crystalline coating that offers considerable friction to gas movement in and out between the crystals. It offers a further and more important protection in keeping the moisture of condensation from direct contact with the rind. Condensation is certain when a cold package is placed in a warm atmosphere, offers a perfect medium for mold growths, and promises heavy losses to fruit not borax washed.

Care is required in packing fruit with rinds showing signs of turgidity or water-logging. Curing, careful drying and parafining are all we can suggest to the packer who would do his part.

Stem-end rotting (Phomopsis) is the hardest for the packer to detect. It is fed from the button, and their removal with ethylene reduces the loss materially. During the incipient stage this disease forces coloring and adds weight so that the diseased fruit may appear to the grader more attractive than the sound.

High bulge packing is another enemy to long holds.

It is a physical impossibility to deliver a high pack, after long storage, free of cut and bruised fruit along the top rim of the box. Juice from such fruit flows to the collars (made of a soft absorbent paper) and from them spreads along the upper side boards. These become stained and wet and in turn encourage molds as well as ruining the appearance of the package.

Now for the refrigeration engineers place in the picture. To date the preservation of grapefruit at Cambridge University demonstrated ten years ago the need of more than cold to hold fruit in sound condition and attractive appearance, and they have worked out methods using a combination of medium temperature and air with part of its oxygen replaced with an inert gas such as carbon dioxide. Results are splendid. Now comes the latest development at Howey in which temperatures cut no figure and an inert gas with all oxygen removed is relied on. The theory of this is new, and results should be satisfactory provided that enzyme action can be stopped without refrigeration, but it will take time to develop a new type of distribution for the gas tight containers called for.

My own experiments have proven immature fruit can be assembled in February and March, and marketed through August in mature, sound, and full colored condition, and that it will hold up during distribution. I've been working along the Cambridge lines using about ten degrees higher temperature than required in ordinary cold storage, and taking advantage of the carbon dioxide gas breathed from the fruit to reduce the oxygen content of the air trapped in the gas tight paper wrapper and thus provide an atmosphere in which the fruit goes very nearly sound asleep with no ill effects.

Cold storage for long holds has proven unsatisfactory, as temperatures low enough to stop cell activity cause pitting of the rind with early fruit. Curing prior to packing is the only remedy. Then again temperature variation with pure air retards or accelerates cell activity to the extent a one degree variation may affect storage life by ten per cent. The release of fruit held close to the freezing point into summer atmospheres is accompanied with heavy condensation, and the hazard of rapid breakdown from mold spores. Its sales life is also shortened by the rapid and material rise in temperature in the fruit; often running as high as fifty degrees within a few hours after leaving storage.

From the growing and storage viewpoint there is no reason why the better half of our good fruit should not be packed for summer sale. Domestic and export markets can absorb such a tonnage at a profit. You are all familiar with the domestic set-up; but few have studied direct export, and no talk on distribution would be complete unless it developed what a powerful factor export is going to be in the future, and how best to encourage it.

NEW CITRUS HYBRIDS FOR FLORIDA

By T. Ralph Robinson, U. S. D. A., Washington, D. C.

In the breeding work with citrus fruits, inaugurated in Florida over thirty years ago by Swingle and Webber, more than ten thousand hybrids have been grown from seed and several hundred have been brought to fruiting. One of the first testing gardens, where some of these hybrids were tried out, was located at Little River, just a few miles north of Miami. Shortly before the 1926 hurricane, when the trees remaining in this old grove were laid low, final selections were made from the hybrids still growing there and these were propagated on new stocks so that none of the promising hybrids were lost through the storm of that season.

Aside from a considerable number of promising tangelos, which will be referred to later, one of the most interesting hybrids to fruit at the Little River grove was a hybrid between the common Key lime (or Mexican lime) and the Genoa lemon. Although the lime was used in this cross as the female parent, the fruits in shape and size more nearly resemble the pollen parent, the lemon; and the flavor and aroma also partake largely of the lemon character.

It is a matter of rather frequent comment that lemon growing has never been a commercial success in Florida. There are several factors contributing to this condition. For one thing, the fruit of the common commercial lemon varieties tend to attain too large a size to conform to trade standards by the time they are mature enough to have the proper juice content. Citrus scab is another important factor, as this disease attacks the lemon with especial severity, causing much loss of fruit and lowering of grade. Its control on the lemon is difficult and expensive. The rust mite is also especially severe on the lemon, producing a condition known as "silver scurf."

As a result of this situation, lemons are frequently scarce in Florida markets, imported Sicilian lemons supplying this deficiency during a greater part of the year. Such importations should not be necessary, and constitute a potential menace because of the possibility of introducing some new citrus disease or pest. Dr. H. S. Fawcett of Riverside, Calif., has recently called attention to a new lemon disease in Sicily, "Mal Secco," which he states is the worst disease of the lemon of which he has any knowledge, not excepting citrus canker. While this disease is not definitely known to be carried on the fruit, he considers it at least a possibility.

The fruits of the common lime are usually quite small and while excellent in flavor are not well suited to common household uses. The Tahiti

or Persian lime, while of good size and appearance, has an individual flavor somewhat different from either the true lime or the lemon and does not withstand storage as well as the lemon.

The Meyer or Chinese lemon, introduced by the United States Department of Agriculture, is a hardy type of fruit and has much to recommend it, but it resembles an orange in shape, size and color when fully mature and has a flavor different from the true lemon and not always relished.

The hybrid resulting from the cross between the Key lime and the Genoa lemon, called a "lemon-ime," seems to meet the need for a Florida lemon in size, flavor, aroma and fruitfulness, with the added advantage that it thus far has proven immune to the two worst diseases respectively of the lime and lemon—lime withertip and citrus scab. Inoculation experiments carried on now for two seasons have established the fact that this hybrid is immune to lime withertip, a specific disease attacking the common or sour lime quite severely in humid seasons.

Under conditions extremely favorable to scab infection, no scab has been detected so far on fruit or foliage of the lemonime. Freedom from both these diseases constitutes an asset of extreme importance in attempting to grow a fruit of this character in south Florida, where high temperatures and humidity are favorable to the spread of such diseases and renders conrol difficult and costly. This double immunity is doubtless due to the fact that the lemon parent is immune to lime withertip while the Key lime is immune to citrus scab,—the hybrid inheriting both immunities.

Because of its physical resemblance to a commercial lemon, and the fact that it serves every purpose of the lemon in ordinary use, it seems best to treat the lemon-ime as a new horticultural variety of the lemon. It is proposed to call it the "Perrine lemon," in honor of Dr. Henry Perrine, the horticultural pioneer of South Florida. It is especially fitting that this new fruit should bear his name as he is reputed to have introduced the Mexican lime on several of the East Coast keys, where his planting of seed about 1838 resulted in a number of so-called "wild lime groves."

It seems worth while at this point to digress somewhat from the main topic to emphasize the importance of the work done by Dr. Perrine in South Florida. The story of his zeal in plant introduction work and his tragic and untimely death, a martyr to his zeal, is familiar to most of the present day pioneers, but will bear repeating for the benefit of newcomers to this part of Florida.

While acting as United States Consul in Campeche, Mexico, he became impressed with the possibilities of growing many tropical plants in South Florida, and he interested a few others in his project, notably Mr. James Webb of Key West and Mr. Charles Howe of Indian Key. In 1838, he was granted by Congress a township of 27,000 acres on Biscayne Bay for colonization and tropical plant introduction. It is an odd coincidence that this grant was located almost adjoining the very tract of land now given over to the Plant Introduction work of the United States Department of Agriculture—that of Chapman Field. Previous to this time he had been sending seeds and plants to a few pioneers in this region for planting and testing.

The disturbances due to the Seminole War prevented the anticipated development of the land grant but late in 1838 he settled on Indian Key, near lower Matacombe Key, and from this base made frequent trips to neighboring keys and to the mainland, planting seeds and plants, leaving them to Nature's care and an occasional visit from himself. Meanwhile he maintained at Indian Key a nursery of tropical trees and plants, anticipating their later use on the land grant when the cessation of hostilities made this possible.

In 1840 a band of marauding Indians attacked the little colony of pioneers on Indian Key and Dr. Perrine fell a victim in the massacre that followed. It is believed that he might have escaped as did his family had he not been sanguine that he could, by parleying with the savages, avert a general attack on the colony. He succeeded in delaying the final attack and doubtless thus, by his bravery and strategy, saved the lives of a number of the people of the colony.

His house was burned down with all his records, botanical collections, and a large chest of

carefully gathered seed. The day after the massacre, the Indians having left, his remains were carefully rescued from the blackend ruins of his home by Mr. Charles Howe, who buried them on Lower Matacumbe Key, by the side of a Sisal Hemp plant which he had greatly prized. The remains were later moved to the family burying ground at Palmyra, New York.

The massive stone foundation of the Perrine home on Indian Key are still intact after nearly a hundred years of exposure, and shows that this pioneer plantsman was building for the future. Had he lived, it is difficult to predict what he might have accomplished in advancing scientific horticulture in this region, for he was not merely an amateur plant enthusiast, but a trained botanist and skilled horticulturist. The scientific name which he gave to the Sisal hemp plant of Yucatan, *Agave Sisalana*, is accepted by all botanists today. The site of his pioneer work on Indian Key should be better known to Florida horticulturists of today. It was my good fortune to visit this most interesting place a year ago in company with Dr. David Fairchild, the present day world leader in plant introduction work. No one is at present living on this interesting coral key, but the Sisal plants introduced by Dr. Perrine have persisted and occupy practically the whole island. It would be only poetic justice, though long deferred, if one of the off-spring of the Mexican lime he introduced should perpetuate his name and bring to the region he loved an additional source of income for citrus growers.

THE CITRANGEDIN

Of less interest to citrus growers in south Florida is a very hardy hybrid between the Calomondin and the citrange—called the "citrangedin." The Calomondin is fairly well known in Florida for its small, bright-red acid fruits, and has proven surprisingly hardy considering that its native home is the Philippine Islands. It has, however, been severely injured and almost killed out in north Florida and the Gulf Coast during the freezes of the last decade.

The citrange is itself a hybrid between the hardy trifoliate orange and the sweet orange, the hybrid fruits having such a pronounced musky quality that they are not usually classed as edible. Nearly all the hybrids in which the citrange has been used have inherited this objectionable pungent flavor, but the citrangedin is the exception.

The fruit resulting from the citrange-Calomondin cross closely resembles the true Calomondin in size, color and flavor, but the tree is decidedly more hardy, standing the winters well up into southern Georgia where temperatures down to 10° F. are occasionally encountered. The tree is ornamental and has much the same upright habit as the Calomondin. It might easily pass for a true Calomondin except for the occasional occurrence of trifoliate leaves, inherited from the citrange. The fruits, while small, serve to make an excellent ade, far superior to any supplied by similar hardy hybrids, and scarcely to be distinguished from ordinary limeade. It is, of course, chiefly of interest and value for the Gulf Coast regions too cold to grow the true Calomondin or the Eustis limequat. It has been named the Glen Citrangedin, for the town of Glen St. Mary in north Florida, near which it has fruited for a number of years past.

THE TANGELOS

The citrus growers of Florida are already familiar with at least two varieties of tangelos—hybrids between the tangerine and grapefruit. These hybrids, called tangelos, resulted from crosses made by Swingle and Webber in 1897 and 1898. Out of a considerable number, two varieties named the Sampson and Thornton, were selected for propagation and distribution. These varieties have proven handicapped as commercial fruits by certain characteristics which have restricted their planting. While thrifty in growth, prolific, and greatly relished by connoisseurs, the fruit needs special care in handling to reach the market or private customer in sound and attractive condition. The modern packing house involves such a rigorous manipulation that a good commercial fruit must have a fairly rough rind and solid flesh.

The Sampson tangelo is so thin-skinned that it is easily bruised; it sunscalds badly, and has a tendency, when grown on the rough lemon stock, to a drying out of one or more segments often

confused with sun scald. It is, furthermore, extremely susceptible to citrus scab, making it difficult in some seasons to produce even a fair percentage of saleable fruit. It is fairly late in reaching maturity—February or later—yet often colors up in December, when it is much too acid to be palatable. The juice of this fruit has attained a growing popularity in making fruit punches or "tangelade;" this use has afforded in the Miami section a fairly profitable outlet for second grade fruit and has encouraged some recent plantings of this variety.

The Thornton tangelo is a much earlier maturing fruit than the Sampson and quite different in appearance and flavor. It is somewhat coarse with a roughened or corrugated rind and becomes soft and puffy when fully ripe. The soft "squirtless" flesh is sweet and melting and greatly relished by many people.

Despite the handicaps referred to, both the Sampson and Thornton tangelos have enthusiastic adherents and will doubtless continue in cultivation, at least on a limited scale.

A NEW SERIES OF TANGELOS

To obviate the difficulties which were encountered with the Sampson and Thornton, a new series of crosses was made some years ago by Dr. Walter T. Swingle and his assistants E. M. Savage and the late Frank W. Savage. It was hoped that by the use of different parents and the growing of large numbers of seedlings from cross-pollinated fruits there might be secured tangelos of better shipping qualities, both early and late maturing, less subject to scab and yet retaining the peculiar zest of these earlier tangelos. These hopes have been realized in a most encouraging degree, although much remains to be learned as to the stock affinities, local adaptations, disease resistance and other points of practical importance. The excellence of some of the new fruits, however, justifies this preliminary notice and the assigning to them of convenient names for future indentification. Full descriptions will shortly be available in a publication from the United States Department of Agriculture, so that only a few brief comments will be given here.

THE LAKE TANGELO (C. P. B. 52018-G-26)

This variety, named for Lake County, where it first fruited, is the earliest of the new tangelos. It matures by late November, holding for six weeks to two months longer in good condition. It is rather small as compared with other tangelos, being the size and shape of a large tangerine or King orange, and nearly as highly colored as a tangerine when mature. It is not loose skinned, being more like a highly colored orange of flattened shape. The flesh is of deep orange color, tender and melting, sweet but not insipid. It was selected for naming and propagation chiefly for its earliness and apparent resistance to citrus scab.

THE SEMINOLE TANGELO (C. P. B. 52018-F-23)

Next in point of maturity to the Lake tangelo is the Seminole. This, like the Lake, resulted from the pollination of the Bowen grapefruit with pollen of the Dancey tangerine. It is larger than the Lake—about the size of a small grapefruit or a large flattened orange—with smooth and glossy rind of deep reddish orange color, fairly tight and firm, that peels however more easily than the common sweet orange. The pulp is of deep orange color, translucent, tender and melting, with agreeable aroma and sprightly flavor, suggesting the Sampson tangelo, but with less acidity. It matures in December, holding well in March or even later. It has shown no tendency to sun scald or drying out, and is decidedly less susceptible to scab infection than most other tangelos.

THE MINNEOLA TANGELO (C. P. B. 52018-Q-4)

This new tangelo is a sister hybrid of the Lake and Seminole varieties but the fruit is usually somewhat later in maturity, being at its best from January to March, or even April. It is named for the town of Minneola in Lake County. It has high color, good shipping quality, and fewer seed than the other varieties selected for propagation. The fruit has the shape and size of a medium large flattened orange, of deep reddish orange color, fairly smooth though slightly roughened

by oil cell indentations. The seeds are small and few in number, seven to twelve, closely grouped at center. The pulp is of orange color, tender and melting, very juicy, somewhat aromatic, a most desirable blending of sweetness and acidity. The rind is firm indicating good shipping qualities, and the fruit gives no evidence of drying out prematurely. It is moderately susceptible to scab, but not badly disfigured even when it becomes infected.

THE YALAHA TANGELO (C. P. B. 52018-K-12)

The Yalaha Tangelo is somewhat later in maturity than the tangelos previously described. It is named for the town of that name in Lake County, where it has fruited for several seasons. It has a slightly roughened or corrugated rind, like the Thornton tangelo, but develops a high color and has a rind decidedly firm, indicating good shipping and keeping qualities. This rind character is so marked that it might almost be described as a "hard-shelled" tangelo. The fruit reaches the size and has the shape of a small grapefruit, about ninety-six size, though often smaller, of reddish orange color when mature. It has a rather large open core and fairly numerous seed. The flesh is very tender and juicy, with ample "character" or acidity when fully mature. The season of maturity ranges from March to May, or even later. There is some tendency to fruit in clusters, which tends to produce pear-shaped fruits, but this habit will become less common as the tree attains increased age.

All these tangelos are considered on their showing in tests so far made as having more or less commercial adaptability, resembling highly-colored and richly-flavored oranges more than they do either parent—the tangerine or the grapefruit.

There are among the tangelo hybrids other interesting fruits of little commercial promise but having an appeal to the connoisseur for some particular quality, and especially adapted to the home fruit garden. Among these is a cross between the Clementine tangerine and the grapefruit. This hybrid is of special interest as the parent, the Clementine, is reported by its discoverer, the late Dr. L. Trabut of Algeria, to have originated as a natural hybrid between the "Granito" a peculiar strain of the sour orange, and the tangerine. The Clementine has become the leading variety of the "kid glove' group of oranges in North Africa, and is being planted more and more in Florida, South Texas and California.

Most of the crosses with grapefruit involving this parent have thus far produced fruit that is rather loose-skinned and puffy, but the trees are decidedly hardy, which accords with the well-known hardiness of the Clementine.

One of the best of this group has been selected for propagation and named the Clement Tangelo (C. P. B. 49855), indicating its relationship to the Clementine. The fruits are rather variable in shape and size, usually resembling a small wrinkled grapefruit but with a depressed area around the stem end. The rind is rather soft and thick and has a characteristic pebbly appearance due to numerous depressed oil cells. It is free peeling with large open core, seeds averaging about one to the segment, though sometimes the fruits are entirely seedless. The most striking feature of this fruit is the pulp which is pale amber in color and of peculiar soft and *jelly-like consistency*, devoid of fiber and easily removed without squirting of juice. The flavor is mild and sweet, low in acidity, but not insipid unless overripe. The Clement tangelo matures in December and January, and is quite distinct from the other tangelos. The tree has leaves with slightly recurved edges like the Clementine, but this characteristic is not so marked as with the latter.

THE WEKIVA TANGELO (C. P. B. 47220)

In a series of back-crosses, a pink-fleshed tangelo was secured as a result of using pollen of the Sampson tangelo on a seedling grapefruit. This pink tangelo (or "tangelolo") has been fruiting in Florida for a number of years past and is already familiar to many growers, but it has never been given a name other than the "pink tangelo." It is proposed to call it the Wekiva tangelo after the famous spring of that name in Orange county.

Although grapefruit served as the female or seed parent in this cross, the pollen parent, Sampson tangelo, proved to be dominant, the fruit bearing less resemblance to grapefruit than to the

tangelo parent. This is not only true of the fruit, but is especially marked in the foliage of the tree. The small, rounded leaves are strongly constricted and recurved like the Sampson, only more so. This variety, also like the Sampson, comes true from seed, as do many of the tangelos. This is due to the occurrence of unfertilized embryos in the seed derived from the nucellar tissues of the mother plant—in effect, the seedlings are like buds of the mother plant.

The fruits are rather small and spherical, of yellow color, resembling grapefruit, but with large translucent and conspicuous oil cells giving the fruit a characteristic glossy appearance. The rind often shows pink blotches, especially where fruits have been in contact. There is an almost complete absence of bitterness in the rind common to most citrus fruits, resembling in this respect the kumquat.

The segment walls and inner rind are tinged with pink or "peach red" color, which gives the flesh the appearance of being colored. The juice vesicles are, however, themselves devoid of color. Seeds usually average one to the segment, though sometimes seeds are entirely lacking in this tangelo.

Besides its rather unique color, the flavor of the Wekiva is also unique, being the *sweetest* when ripe of any citrus fruit known to me which is at the same time palatable. The fruits ripen in November, holding in good condition for several months, though the color fades as it reaches late maturity. In earliness and sweetness it is in marked contrast to both parents which are fruits of high acid content.

The tree is a weak grower in Florida and it is not recommended for commercial planting. Despite this fact, the fruit is so well liked by many people that it will probably find a place in variety collections and home fruit gardens.

THE TANGORS

Closely resembling the tangelos in general appearance are some of the tangors, i. e., hybrids between varieties of the mandarin group and the common sweet orange. Such hybrids have been fruiting for a number of years and the resemblance to the tangelos is so close that for horticultural convenience they may well be classed with tangelos, a class of fruits now fairly well recognized by citrus growers and gradually acquiring market recognition.

Of especial interest is a fruit resulting from the pollination of the Satsuma orange with pollen of the Ruby ("Ruby Blood") orange. This cross has resulted in an interesting combination of characters and at the same time furnishes a delicious fruit of handsome appearance. In contrast with the parents, both fairly early maturing varieties, the hybrid is decidedly late, maturing in late February or March, about the season of the King orange, which it somewhat resembles in shape and size though much more attractive in appearance. The tree so strongly resembles the ordinary Satsuma orange in foliage and habit that, but for the unique character of the fruit, doubt might be raised as to its hybrid origin. The name *"Umatilla,"* an Indian name of Lake County, has been chosen for this new fruit which, as stated, is classed with the tangelos.

The fruit is much flattened and fairly large, three to four inches in diameter, not free peeling like the Satsuma, but with a very thin firm rind, smooth and glossy, of orange color. The flesh is of deep salmon color, very juicy and tender, of rich vinous flavor, somewhat suggesting the King orange. Seeds are fairly large and variable in number, usually averaging one to the section, sometimes eitirely lacking. This hybrid is somewhat difficult to propagate and is not a rapid grower. It is not recommended for commercial planting at present but offers a luxury fruit of first order for the home garden and private variety collections.

SUMMARY

These new fruits produced as the result of cross pollinations are interesting in their surprising variety and unusual combinations of characters.

As already indicated, they are not as yet recommended for large scale commercial planting, but offer specialty or "luxury" fruits suitable for the private order trade and for the home fruit garden. Some of them will doubtless be found better adapted to certain regions than others.

Stock affinities are also likely to prove important in their utilization.

Disease resistance, especially resistance to scab, is still to be tested under different climatic conditions. Co-operative tests to determine the influence of these factors have been arranged in typical citrus soils and areas of Florida. These tests within a few years, we believe, will show which variety or varieties will suit local conditions and which, if any, other possibilities for growing on a commercial scale.

Dr. David Fairchild: I wish to announce that I am a tangelo fan, and I would like to tell this. When Dr. Swingle and Dr. Webber established the citrus garden at Little River, I didn't dream I would be dragged into the game as tester of 4736 crosses that grew there in that remarkable citrus collection, but I had permission from Swingle or Robinson to give him a report on these fruits. I think Mr. Brooks, I am not quite sure, joined this party. There were three of us walked down one row and up the other. It took us two days, and we were there from early in the morning until late in the evening, and I am very proud of the fact that I succeeded in tasting the other two fellows out of it and remained at my capacity to absorb. It was a very amusing experience, and I thought when I came here this winter I was through with testing but there arrived a box of twenty-five new ones, and it took me a week to test them, and I assure you gentlemen that its time that you took these seriously. I don't mean in a commercial sense as outlined in the discussion this evening with regard to the amount of acid and alkilinity, but in your own gardens. The taste of the tangelo is to me more interesting than the taste of any other citrus fruit. I know there are a good many people that don't agree with me, but that doesn't make any difference. I can assure you that as a breakfast fruit and as a drink the tangelo is something you have got to figure on. If you are going into the market with something new Mr. Robinson has presented you with something new, with which you should begin by planting a tree or two in your own yard and getting acquainted with it. I have a collection on my place at Coconut Grove. The game of testing these, and becoming familiar with their uses is a strongly interesting game.

Mr. Brooks, Miami: I want to say that I think you will all agree with me why the work that Mr. Robinson has done is of such great interest to others than myself. If there is anything we like to do it is to have a look-in on something new, and with Mr. Robinson's trips here it has always been with great profit, when it has been my pleasure to hear him. I am sure you have all found the same thing of Mr. Robinson's work, and his reports of his work.

GRAPEFRUIT EXPORT

By Mark Hyde, Refrigeration Engineer, Jacksonville, Florida

Yesterday, in my paper on grapefruit distribution I endeavored to develop that the immediate future threatened crops twice as great as can profitably be marketed under present methods of distribution; whereby the industry loses the whole of the summer demand, both at home and abroad. I also went on record that, were the grower, packer and refrigeration engineer to work together, the problem of over-production, or more properly under-distribution could be solved by picking the choicer portions of the crop prior to April and holding for a summer outlet.

Gentlemen, if you do this, it will be the greatest step forward the grapefruit grower has ever taken. If you don't, there is no hope on the horizon, and I've spent too many years analyzing marketing problems, and the last five years on this one problem alone, not to know whereof I speak. You can, through summer distribution, double the tonnage now possible of profitable

sale, or you can sit idle and let Texas cater to summer demand at home, and South Africa abroad, and, by establishing their brands when the public actually wants grapefruit, so establish their prestige as to further weaken your winter demand.

No jobber or retailer is very keen on any brand he cannot guarantee steady delivery of; no buyer can be educated to insist on such a brand, and its advertising is mostly money thrown away. You have no conception of the research lengths to which South Africa is going to overcome the evils of on again, off again marketing—and she is rapidly solving them in the hopes of so serving England and the Continent her grapefruit will become the standard. The Strachan Shipping Company, since 1927, has been a firm believer in the feasibility of building a splendid export outlet, were direct sailings from Florida to Europe possible and provided. Our president, Mr. Frank Strachan, in that year deflected a fleet of refrigerated English ships from a profitable apple movement to an experimental season between Jacksonville and Liverpool. His belief that fruit shipped direct would arrive in so much better shape than possible by rail to New York and water over, was justified to the extent that the first two trial cargoes of 5,000 boxes each topped all competition by twenty-five cents per box; and a total of seven cargoes, amounting to 37,000 boxes, found a profitable market. This in the face of no reduction via New York, and no advertisiing whatever in England.

On the strength of this, and without the guarantee of a single box for the next season, he invested several hundred thousand dollars to provide specially refrigerated fruit vessels operating under the American flag, and the 1928-1929 season saw 250,000 boxes handled direct. Still, with no reduction via New York, no advertising and no summer movement. Last year, the fly pest reduced the tonnage to 56,000 boxes, although ten times this amount could have been absorbed as profitably abroad as it was at home.

For the past four seasons, including the present, this movement has been highly unprofitable to the water interests, owing to its irregularity and shortness, yet Mr. Strachan has gone ahead and spent another $50,000.00 in research work to prove that fruit could be held for Summer distribution and that when held, a profitable export promised. I mention all this that the industry may see to what extent the water interests have co-operated in the past, and to show how they have anticipated, with no guarantees, your need, and, to reiterate the statement recently made by our Vice-President, Mr. R. W. Graves, at Washington, "as the business developes, the grower may feel every assurance facilitaties to care for it will be provided."

How best the grower, water interests and foreign distributor can co-operate to make export the success it promises has been my study from the beginning. Four trips abroad, the last covering from November to April of this year, with five seasons of storing fruit in blocks of ten to over fifty cars a season at representative warehouses in the United States, Canada and England, have naturally permitted the gathering of a fund of useful information, all of which is available to the industry free of obligation of any sort; and the balance of this paper will be occupied with as much of that data as time permits.

THE ENGLISH GRAPEFRUIT MARKET

After a full survey with Independent and Exchange Brokers, representing over ninety per cent of the imported tonnage of citrus from Florida, I feel conservative in estimating the English demand, backed by an export brand and advertising, will absorb within two years, fortnightly, direct cargoes to the south of England and monthly to the north of England, of 16,000 boxes each from December to March—with average returns of sixteen shillings; and weekly cargoes to the South and fortnightly to the North of the same capacity from March to July inclusive—with average returns of twenty shillings. The market will show a consistent rise in volume and price right through July, reaching a peak about August first—at which time South African grapefruit, an Empire grown product comes in, and policy dictates Florida step out. And this tonnage should be possible of doubling or trebling inside five years if the three interests referred to co-operate as they should.

Florida starts exporting just as the English climate becomes too cold and disagreeable for any

demand but hotel, restaurant and the fancy trade. From November to late February temperatures range between thirty and forty-five degrees; with a majority of the days dark and disagreeable from rain, snow or fog.

The average English home is not furnace, or centrally heated as in America. The family dresses and washes in cold rooms with cold water; and nature demands a hot, heavy breakfast. Grapefruit has no place on such a menu, and has, so far, failed to reach the enormous markets offered by the poor and middle classes.

Another factor tending to discourage either a good demand or price is that early grapefruit from Florida are of the seedy varieties; low in juice and sugar content. Due to being picked early in the season, with no opportunity for sun curing the rind, this fruit, when held over a few weeks at low temperature, developes a disfiguration known as 'Storage Pit.' The combination of an unattractive surface artificially colored, and a sour juiceless meat logically results in curtailed demand.

Seedless fruit has a tough, fully cured rind from a long winter on the tree, has a high sugar and juice content, and is the best variety for export. Yet, if this fruit be left on the trees after March, it grows too large and becomes over-mature for summer distribution; and so to date the export market sees but little of Florida's good fruit. The only accountable reason for the happy growth of the movement to date is that Florida seedlings are about on a par in juice and flavor with the South African product that goes off the market as the former comes on.

In years, such as the current, when no late bloom fruit blossomed and the season came in early; seedless varieties reach oversize for export before that demand even opens, and the season's movement becomes a failure unless arrangements be made for picking and assembling such fruit before it reaches oversize.

English brokers are shrewd enough to realize that high returns on early arrivals create a wave of enthusiasm promising good volume later; and growers may receive fictitious returns at the beginning to insure later over-shipping, and to win their season's favor to brokers with none but their own personal interest at heart. This condition often arises in November and December, and leads shippers so benefitted to refuse aid to any propoganda tending to limit too early a movement of under-ripe,artificially colored fruit.

The market is controlled by thirty-three receivers in port cities, who, through their associations, handle the entire distribution to over 4,000 major retailers. These, in turn, are interlocked for mutual protection by their association.

The costs of producing and marketing grapefruit in England show that sales at sixteen shillings ($3.82) are more attractive for 80's and smaller than domestic markets offer.

Summary of Costs:

Growing, allow per box	$ .50
Picking and Packing	.70
Transportation to Jacksonville	.25
Pre-Cooling at Jacksonville	.12½
Wharfage at Jacksonville	.04
Transportation to England	1.00
Insurance	.03
American Costs	$2.64½
Port Charges, London	$ .12
Cartage to Covent Garden	.06
Porterage at Covent Garden	.06
Average Jobber's Margin, 7½% gross	.30
Average Distribution Costs to Retailers	.12
English Costs	$ .66
Total Costs	$3.30½

From the above figures it is obvious that under the poorest of export market conditions growers are assured growing costs. Nor should the benefit accrueing home markets from elimination of off-sizes be overlooked.

It is interesting to note that at sixteen shillings wholesale for 96's and 126's, retailers can afford to sell at six cents (three pence) each, and allowing five per cent waste, net $6.35 average per box; or sixty-five per cent margin. This is satisfactory to them and in line with their other fruit buys.

Three-pence, during the Winter, promises an attractive retail demand and the estimates given earlier should be exceeded.

During the summer an eight cent (four pence) average would also assure the estimate given as conservative.

Any thought that England offers a prospective dumping market for a large tonnage at prices below cost of production shows a gross ignorance of their protective policy. As long as Florida maintains an orderly marketing program from December through July, and at prices not disturbing to production costs of South African grapefruit, just so long may she expect enjoyment of their markets.

The present feeling in Florida that English receivers take too large a remuneration for services rendered is unjustified. Retail stores are invariably little more than cubby-holes. Most of them can handle not over two boxes at a time, no matter what the price inducement, and receivers must carry the bag. This, in turn, shows the need of bringing distribution into as few hands as possible; for, until it is done some receivers are certain to become weak-kneed with the arrival of every large cargo, and dump enough of their allotments to force a lower level for all.

SUGGESTED IMPROVEMENTS IN DISTRIBUTION SERVICE

The following suggestions, if adopted, would have a most beneficial effect: (a) Encouragement of an exclusive export pack and brand based on English Auction grading; not on U. S. No. 1's and No. 2's, as at present. The latter (No. 2's) are simply a mixed pack; which in many cases under English grading should be No. 1's, and the grower needlessly loses.

A standardized export brand for 80's and smaller only, should replace the dozens of brands now shipped—and all of which can be bought on New York Auctions. California ships but one brand of orange (Sun-Kist) and is successful in sales and receipts. South Africa, with over 600 brands of grapefruit, like Florida, is doing herself much harm; neither have any standardization and neither merit nor hold the Auction's confidence.

(b) The letters "U. S." or words "United States," should be given as little prominence on packages as the law permits. There is a strong educational campaign on in England to influence the buyer in demanding Empire Grown Products. Posters and newspapers preach it wherever one turns, and every effort to keep out of the limelight of this Government fostered campaign should be made. Florida now has a bad reputation, owing to suspected past dumping practices, and would receive scant consideration were she to force undesirable notoriety on herself. Fortunately, her season need not conflict with South Africa and I believe it policy to make it a point not to attempt interference by August deliveries of summer held fruit.

(c) Growers should be induced to reduce the present high bulge to not over two and a half inches, and eliminate the use of collars.

It is a physical impossibility to deliver a high bulge pack free of cut and bruised fruit along the top rim of the box. Juice from such fruit flows to the collars (made of soft absorbent paper) and from the collars is distributed along the upper side boards. These are stained and wet on arrival, and the refrigeration often blamed.

(d) Box covers should be of slat rather than solid board construction. Better ventilation, refrigeration and inspection facilities are provided, as well as a saving in first cost for covers.

(e) A proportion of every cargo should consist of half-box packages. These will prove a good week-end inducement to the buyer and should materially swell volume.

The use of slat covers on half-boxes of unwrapped fruit permits inspection of every piece without opening, and protects the retailer from returns.

(f) Tissue wrappers should be eliminated on current shipments. They retard refrigeration and inspection, and are strongly objected to by English retailers with stores too small to permit accumulation of waste. Buyers will not purchase sight unseen, and fruit is never displayed in the box; always on shelves and unwrapped. Shelves are usually the window itself;—that is all the average establishment consists of.

Savings effected in wrappers and collars would off set the added cost of two half boxes versus a whole one.

(g) The Spanish practice of using 120 pound, three cubic foot boxes, with two partitions, for smaller sizes merits a trial in Florida. The small retailer can handle not more than two boxes and prefers those as large as he can physically manipulate.

All these suggestions are self-evident. You can subscribe to them and still maintain your own identity; except the packing under one brand, and the agreeing not to permit that brand being offered for any but direct export movement. The success of export stands or falls by your decision here. Fighting hasn't accomplished much in the domestic dilemma; so why not profit by past experience and in this new venture deal a fresh hand and work together for the good of the whole?

The Exchange has a splendid sales organization abroad in the house of S. B. Moomow & Co. The group of Independents who have furnished the bulk of the tonnage also have a splendid outlet in the house of Roberts Brinning & Co. Both operate on the same lines and both are protecting the shipper to the limit of creditable salesmanship; That side of the triangle offers no difficulty, and there are only two other sides—grower and transportation company.

So far, every Independent I've talked to, (referring to four of the largest,) has been agreeable to the formation, and participation in, an export company for accomplishing this purpose, as well as putting over an advertising program and such other precautionary measures as promise success to export. The Exchange management assures every co-operation and, so, Gentlemen, this side of the triangle also promises solution.

Were such a Company formed, the majority of export tonnage would come under its control, and limits could be set on every broker on every auction as to the amount of fruit he might offer each day; as opposed to present practice, in which every grower whose fruit reaches more than one broker (and most of it does) becomes his own competitor by the token if either broker is weak, he undermines the market for that brand.

Such a Company would control all 80's, and smaller packed under its brand, and, through its advertising power, build a demand so great in Europe, New York would be eliminated as a factor in breaking export markets. Other brands picked up on New York auctions at sacrifice sale would find themselves so penalized in competition with the established brand as to be unprofitable.

All 96's and smaller should be exported or processed. Under no circumstances should they reach New York, where there is no local demand, and their only hope an export sale on the auction. For example: when any well-known brand, reaches twenty-five shillings in London, and can be purchased delivered in small lots for twenty shillings through New York, the entire market on all brands is needlessly weakened; where a control would see such sizes were unobtainable at New York. The idea of one brand known purely as an export article opens a splendid opportunity for competition against all comers; no matter how strongly they may now be established through advertising.

An essential feature to the success of export is an advertising program starting in England and spreading over the Continent by its own momentum within a few years. This can only be accomplished by such a Company as proposed.

The writer spent several days selling grapefruit over the retail counter in both the rich and poor districts this Winter and found a serious mistake has been made in trying to educate the public to eat a grapefruit, no bigger than an orange, from the rind. This idea evolved in America for the use of 64's and larger. Such fruit can be halved and the exposed hearts neatly cut from the rag, but a 96 or 126 looks like hash, no matter how expertly the cutting be done; and the housewife's answer when pressed to buy was invariably the same,—"I can't be bothered."

She is asked to buy a grapefruit knife at two to three shillings in order to eat something she knows nothing about and has no interest in—just the contrary—for its a foreign product. With a knife it takes an amateur five minutes to prepare a fruit, and after her good man has forked out the splinters of meat he must to get any food at all, pick up the already mal-treated rind in his hands and squeeze the juice in a spoon; with the natural result—part on his waist coat, part in his eye, and a bit in the spoon. The next time she "Can't be bothered."

The average Englishman has never heard of any way of eating citrus fruits except in the form of juice. The rich drink theirs, the poor suck theirs. They are hard to change, especially where the suggested change is obviously stupid. When,

I demonstrated the simplicity of halving a 96 and squeezing the juice out by means of an ordinary glass burr into a tumbler, and produced an equal amount of juice to that obtainable from four cheap Spanish oranges, yet produced in one quarter the time and possessing greater health giving properties and a better flavor, all for three pence, or less than the oranges cost, buyers were instantly sold. Store managers, plainly antagonistic before the demonstration, became keen boosters after it—for it is easier for retailers to handle one fruit than four, when profits are equal.

Present advertising is obviously all wrong and must be corrected if the consuming public, represented by the poor and middle classes, is to be reached. To date, it may be said not over one per cent of this class have ever tasted a grapefruit, and the other ninety and nine must be won through channels acceptable to them.

The Spanish orange is not Empire grown and you need fear no odious legislation from public comparisons. The rind of this orange is brittle and often cracks before the juice is all removed. It is difficult to gather the small amount it does contain without messing the fingers.

Only through an export company could financing the growing and packing of such a tonnage be arranged. The fact it put up but one brand, and that to agreed specifications, and nationally advertised, would justify banks, the Farm Board, or interests forming part of the triangle itself in aiding.

The probability of the growers getting together is good. Our Company is on record as to its desire to do its share in financing an advertising campaign and co-operating in every way to the success of the venture thus closing the triangle. The Roberts Brinning Company is on record as to its intent to match the growers in any retain up to five cents a box for advertising. Their Director will be in Florida in May to remain as long as necessary to place before every interested grower all information relative to the project.

In closing, Gentlemen, the plan I've laid before you opens the only path to salvation. It shows the way to develop a large tonnage, not only profitable to the grower but of such magnitude it should open a way to lower water rates, and I assure you the water interests would like nothing better.

The present rate of one dollar to England was established only after a series of conferences with interested growers and only after their assurance it would encourage growth of the export movement. A full fruit cargo of 16,000 boxes provides less than one-third the income a vessel must earn to make the round trip profitable. To date, there have been no profits; but a seven to eight months movement through a port providing sufficient common cargo to make up the balance does promise a cheerful prospect for better rates. Jacksonville is the only port in Florida offering, or possible of offering, such a tonnage and, if we are to best serve the grower, we plead for his co-operation in our efforts to establish that port as a base. It alone guarantees success of the venture, and any efforts to divert or divide the tonnage with other ports can result in naught but expense to all, and retardation of the movement.

Member: I would like to ask the question about those collars you speak of. Isn't that fading mostly due to the colored collars; couldn't that be avoided by the use of white collars?

Mr. Hyde: Yes, it can be avoided by the use of white to some extent, but when you stand on the piers, at Liverpool, and see the competitive fruit unloaded, with no collars, no matter how carefully you handle this, its subject to stevedor labor. Its packed seven high, and the easiest way an Englishman can handle the top row, and next to the top, is to put it on his shoulder and walk to the hatch and let it go on over. The box with a cleat will stand that smash, but the collars are invariably torn. You might have 1,000 cases to be piled on the pier, and it is there subject to survey and inspection before it leaves the pier. Even if those collars are white they are a rather sorry looking cargo in comparison to fruit from Spain or California without collars.

Member: I would like to ask if there is any chance of getting ventilated fan boats direct from Jacksonville over there, so we might ship like from out of New York.

Mr. Hyde: Yes, there is every chance of getting those, but our whole thought has been an extension of the season into the summer months, and the only fruit that would move would be out of cold storage, and coldn't travel when loaded above the ship. Your movement is going to be South Africa. There is nothing in the world to stop us from giving you ventilated service, but I think you will find you will be penalized more than sufficient to offset that.

Member: One reason why I made that suggestion was because I notice this season, particularly with our anthracnose, and on my shipments arriving in Glasgow, Liverpool or London, I noted considerable more damage from anthracnose on refrigerated shipments than on ventilated shipments where the Temperature wasn't lowered and raised on the other side. When it arrives at the other end there is very little difference, but after the fruit comes out of the refrigeration and has set around in the auction room, I have had some rather distressing results on some of that fruit that had to set around.

Mr. Hyde: Were you present when the fruit was removed from the ship?

Member: No, but I had surveys made of it.

Mr. Hyde: Your fruit was probably picked a little too early. It was artifically colored, wasn't it?

Member: No, it was fully ripened fruit.

Mr. Hyde: The last cargoes I saw unloaded showed none of that storage pit whatever. The late fruit that is overmature and there is danger of stem-end rot must be carried as close to the frost line as possible but with fruit that has been thoroughly sun-cured on the tree, there is no danger of that. My experience is that your early fruit that is good enough to go over there should be delivered in absolutely sound condition on about a forty degrees temperature mark, without your having any trouble whatever. A lot of you gentlemen will specify when your fruit goes in cold storage the temperature you want it precooled at. Lots of cold storage people tell me their orders are to precool at thirty-two degrees.

Member: It is just in the past few weeks, particularly in the ridge section, that we have had this anthracnose develop. It develops sometimes even in New York shipments, but it seems when you bring it down under refrigeration that way it seems for some reason or other to break down on the other end, more so than straight ventilated shipments. We have had stuff in the house that we have picked and some of the worst, and treated it, and it stayed up in apparently good shape, and when we put it under ventilation, and it set around the office it had to be sold right now.

Mr. Hyde: I have seen that quite often, but I have seen none at the time of discharge from the ship. It has been developed later, due to weakness of the fruit, and I believe it stood up longer on account of the refrigeration than otherwise, and I think you are still better off. You are going to have competition with South Africa on the Temperature basis.

REFRIGERATION WORK IN THE EXPERIMENT STATION

By A. F. Camp, Agricultural Experiment Station, Gainesville

One of the outstanding needs of the citrus industry in Florida has been the extension of the marketing season. We have been faced with the necessity of marketing an ever increasing volume of fruit in a period of seven or eight months. This not only crowds the market badly but leaves several months during which Florida citrus fruits are not placed before the buying public. The problem is further complicated by the fact that many of our varieties of citrus fruits have a very marked and comparatively short ripening period and must be shipped within that period. In addition to this we have for several months a very large market for citrus fruits within our own state which we cannot supply. As a result we have periods when, in large crop years, fruit is

present in a great surplus but so far we are without adequate means of holding this surplus over for the periods when we have a market and no fruit.

Some means of lengthening this period of marketing is greatly to be desired and it is natural to turn to the problem of cold storage as offering one of the most feasible answers. Cold storage has done a great deal for the apple industry and today we buy apples months after they have been picked. This extension of the apple season has been of untold value to the apple growers and gives us a key to what might be possible in the citrus industry along the same lines.

With methods available by which citrus fruits could be held safely for from three to five months, it would be possible to eliminate the present shipping peaks which injure the market and to carry the extra fruit over into periods when the pressure on the market is lessened. It would also be possible to carry fruit in storage through the summer to supply our own and other summer markets and further relieve the winter markets. By relieving pressure on the market at critical times and supplying markets now unsupplied it would be easily possible to add tremendously to the value of our citrus crop.

Unfortunately considerable difficulty has been experienced in the cold storage of citrus fruits. The results have been uncertain and the losses heavy; where many have succeeded splendidly, followers in their footsteps have experienced heavy losses. A great deal of work remains to be done before we can get the best results from cold storage but it appears to offer the best available possibility for extending our citrus season immediately with the grove acreage now planted.

Together with cold storage of fruit, we find developing the idea of marketing the fruit in other forms than as fresh fruit, i. e., as canned fruit or juice, frozen juice, marmalades, etc. The canning of grapefruit already offers a market for sound grapefruit that is unsightly in appearance or off size. This relieves the pressure on the fresh fruit market and permits the more sightly grades of fruit to be marketed to better advantage. A similar relief is to be hoped for in the orange marketing situation as the result of the establishment of the marketing of frozen orange juice. This product is being studied on a large scale in this state at the present time and upon the successful marketing of the large amounts of juice now being produced hangs a great deal of interest.

Like the canning of grapefruit, the marketing of frozen orange juice tends to relieve the market congestion for fresh fruit and also to extend the marketing period into those months when we ordinarily do not have fresh fruit available. To a certain extent these products compete with the fresh fruit but all plans have their weak spots and in both of these cases the good effect should greatly outweigh the ill effects. The last three seasons have shown strikingly that the marketing of a small amount of fruit is much more profitable than the marketing of a large amount and it is hoped that these various outlets for No. 3 fruit will enhance the value of the higher grade.

Realizing the importance of the above considerations we have, during the past year, constructed at the Experiment Station at Gainesville an experimental refrigeration plant with which we hope to be of some material help to the industry in solving some of the problems pertaining to the cold storage of fruit and the freezing of fruit pulps and juices. We now have available six rooms for storage experiments and these are being run at the following temperatures: 30, 36, 42, 48, 54 and 60 degrees Fahrenheit. Each of these rooms is controlled accurately within one degree Fahrenheit (1°F.) and each is capable of accommodating a half carload of fruit without interfering with proper air circulation or the accurate maintenance of temperature. With this range of temperatures it should be possible to have temperatures both above and below the optimum storage temperature—a very necessary requirement in carrying on experimental cold storage work.

In addition to the storage rooms we have two freezer rooms—one operating from 0°Fahr. to -10°Fahr. and one at +10°Fahr. These rooms are for use in carrying on experiments on frozen products and are chiefly used for the storage of such products. Some additional facilities for this work in the shape of a small quick freezer are being installed and will be ready shortly. This equipment will include a small low temperature

brine bath operating at -20° to -30°Fahr. or any higher temperature desired and furnish brine for any type of equipment desired. Lower temperatures than -30°Fahr. are obtained with Dry-Ice but such temperatures are not ordinarily necessary in fruit work. With the above equipment we will be prepared to handle all ordinary lines of research on frozen products and cold storage that may arise.

In the handling of citrus fruits in cold storage there are three chief problems: (1) the drying out of the fruit; (2) pitting of the rind, and (3) decay. We are planning experiments designed to throw additional light on all of these problems. We already have work started by a graduate student, Mr. Fifield, on the use of various types of wrappers such as waxed paper, oiled paper, Cellophane, parchment, aluminum foil, etc., to determine the influence of such wrappers on keeping quality of the fruit. This work is being carried on at all temperatures as the fruit frequently reacts differently to temperature when different wrappers are used. Other work on the effect of surface coatings and other treatments has been started and we have a few fruits that have been kept in good shape since the middle of December, 1930. The effect of temperature and humidity is, of course, of fundamental importance but the situation is complicated when the fruit reacts differently to temperature, according to treatment and wrapper. As usual the amount of stem-end rot in stored fruit has been discouraging but it is hoped that the Plant Pathology Department will be able to aid in the solution of this vexing problem.

Beyond the immediate problems we find the very difficult problem of estimating the value and importance of the effect of cultural treatments on the keeping quality of the fruit. This field will have to be extensively explored and we are planning work with this particularly in mind. It is not at all improbable that in years to come citrus fruits may be cultured particularly for cold storage, the fertilization and cultivation being adjusted to this end. In any such experiments the variety and rootstock and the soil as well as the fertilizer and cultural treatments will have to be considered.

There is an additional problem in such work and that is the problem of what happens after the fruit is removed from storage. Fruit may keep in splendid condition in the storage rooms but go to pieces in a very short time after it is removed from storage. This is not important where the fruit is being removed from storage and immediately juiced as has been the case in some of the northern cities where companies operating orange juice stores have stored fruit for summer use and removed the necessary amount of fruit each day. It is a problem of prime importance, however, when the fruit is to be merchandised through the regular channels so that it will be out of storage two days or more before being consumed. All of our work calls for the examination of the fruit at various intervals after removal from storage in order to take care of this important point.

In addition to work on citrus we are also studying the effect of storage on other fruits and another graduate student, Mr. Lyle, is studying the storage of avocados. This work has already developed some very interesting angles. I hope that at the next meeting of this society he will be able to offer a very interesting paper along this line.

I want to turn now for a moment to the question of frozen products. When Mr. Clarence Birdseye started the quick freezing of fish he started what has developed into the beginnings of a great field of work. The idea of merchandising perishable foods in individual containers in a frozen condition bids fair today to affect modern horticulture as extensively as did the tin can a few years ago. Already meat and fish in frozen package form are standard products and such horticultural products as raspberries, spinach, peas, peaches and now orange juice are being extensively marketed and received with great favor. Many of the products are the equal of the fresh material in quality and are even indistinguishable from it.

In the not distant future the housewife in our larger cities will be able to buy a complete dinner in the frozen state and with the simplest preparation place it on the table. I recently had the pleasure of eating a luncheon made up almost entirely from frozen products—fish and steak of the very best, peas, asparagus, and corn indistinguishable

from the fresh product, and frozen raspberries and cream for dessert—all of the products frozen last summer.

The limitations of this sort of marketing are rapidly being eliminated. Processes are being worked out for freezing various types of products and the best varieties for freezing and the best type of package for marketing are being determined. The refrigerator companies are designing show cases for displaying products in stores in the frozen condition and electric house refrigerators are coming out with compartments for holding frozen foods.

This development is separate from the bulk freezing of fruits that has been used in some fields for several years. Strawberries, for instance, are packed in a large scale for preservers, the fruit being packed with sugar in barrels and frozen and retained in this condition until the preserver is ready to use it. Fruit is now being packed in this way in Florida for shipment to northern canners and to pie bakers. This sort of thing is quite different from the development of the individual package method of freezing in which the product is frozen in a package of suitable size for home consumption.

The freezing of orange juice is a part of this great development and will have in its favor the great national trend toward frozen products that is now taking place. Additional impetus has been given to the movement by the difficulties attached to canning the juice successfully. Two companies are now freezing the juice on a large scale, using the individual package and intend to deliver it by milk wagon through their present distributing system. So far the work of marketing this new product is proceeding under the most favorable auspices and the highest standards are being maintained in the production of the product.

Just what the future of this development will be it is difficult to say. Much will depend on the large scale experiments now being carried on. Probably at this point a note of warning should be sounded against too optimistic expectations. As now constituted, the juice plants offer an outlet for No. 3 fruit similar to the outlet offered in the grapefruit industry by canning. The companies involved are expending large amounts of money in this work on this basis, whereas there has been a tendency in some quarters to expect more of them. The growers of the state must work with them in developing this new industry if we are to benefit properly from its development. Florida is the natural setting for the development and we should strive to keep it here to as great an extent as possible. Other citrus areas are not asleep to the situation and are likely to offer inducements for such developments that we will have to combat in the future. Extensive experiments are already being carried on in California and some foreign countries along this line and we will have to keep pace if we are to hold our initial advantage.

There is still a great deal of experimental work to be done on frozen orange juice. We know far too little about the actual constitution of the juice and the factors influencing its keeping quality. The last word has not been said on methods of either extracting or freezing. The relation of varietal and cultural characteristics to the keeping quality of the juice needs to be determined. Much effort is being spent in determining the best means of keeping the counts of bacteria and yeast at the lowest possible point. Florida has a "head start" on these problems and we hope to maintain our advantage.

In addition to orange juice we have many products that we hope will be adapted to the freezing process. Already at the Experiment Station plant we have found tangerine juice to be an exceedingly palatable product and blends of it with orange juice of fine quality. Tangelo juice has a tang all its own and may prove to have real value commercially. Frozen grapefruit hearts are splendid in salad and as a dessert but more work needs to be done on their keeping quality. Many other fruits, such as mangoes, avocados, papayas, persimmons, blueberries, strawberries, etc., need to be studied. In this field we hope to lend a hand where it is much needed and to help retain for Florida as much of this industry as possible.

STANDARDS OF MATURITY IN CITRUS FRUIT

Clinton Bolick, Ft. Myers

The first static in the domestic circle was about fruit. Whether it was an apple, an orange or a grapefruit, or whether it was mature or immature, is a matter of conjecture. Certain it is that it resulted in fig leaves. This matter of standards of maturity in citrus fruits in Florida comes dangerously near convincing us that, as some claim, Florida is Paradise, and if Adam does not reform and stop his meanness and quit passing the buck, we will soon be back in the fig leaf stage. That same habit of eating has come right down the human line to us. There is a larger range to satisfy our appetites, and we choose those fruits that are most pleasing to our tastes.

It would seem that the Standard of Maturity in citrus fruit must conform to the taste of the millions for whom they are grown to be eaten. There was a time when citrus fruits were not offered from Florida to the consumer until nature indicated maturity by practically full color of the peel and the buyers came down to Florida to seek that kind of fruit to start the season right and kept Florida fruits moving steadily into consumption. That is the rational test. Nature makes few mistakes, if any, but she does produce some monstrosities. One of these is the Adam that defies the laws of Nature to destroy the quality of Florida citrus fruit, by taking them from the tree and offering them to a willing consumer before they are fully matured.

The consumption of Florida fruit seems unlimited when they are fully ripe and the consumer is the real arbiter of the standard of maturity. From year to year we are confronted with the evil habit of sending immature fruit to market. This fruit gets into general distribution and shuts off the buyer who wants real Florida citrus fruit and the consumer and the buyer as well goes on a strike and neither buys nor eats more until he is given some good fruit. The past season we have given millions of boxes to those who have been disgusted with the immature fruit which has been foisted upon them as ripe fruit.

To overcome this insane defiance of natural law, for twenty years Florida has been trying by legislation to establish standards to permit only palatable fruits going to the market, in order that Florida fruits may go into liberal consumption at the beginning of the season. But so long as men can violate the laws of Nature and the state for a profit to themselves, they seem to be able to find others who will supply them with fruits to destroy the market to the undoing of the industry and they pass the buck to criminality.

There is wide diversity of opinion in the matter of maturity of citrus fruit. There always will be. In establishing standards these have to be taken into account. This Society went on record favoring a restraining law in the moving of citrus fruits from the state that were not up to the given standards of maturity. There was a bitter fight before the legislature in 1911, the Florida Citrus Exchange on one side and the so-called independent shippers on the other. A very inadequate law was passed with eight to one for oranges and seven to one for grapefruit, and providing that if they showed two-thirds color on the trees, it indicated maturity, and they were to be exempt from the acid test. The color test nullified the law, and besides, with only four inspectors, politically appointed, the shipper became the only judge of what was to be shipped. From time to time new laws or ammendments to the other laws have been passed, and each year this same problem is with us. The standards that we have or are trying to get seems to be as near as can be had to proper maturity and one of the weak features is the clause in the present law which provides the lack of enforcement.

Until 1929 there was no standard of maturity for tangerines. The present law passed by the legislature in 1929 fixed a standard of eight to one sugar to acid and all tangerines to be deemed mature after November 15th. The sixteenth of November found 500 cars or more ready to ride to market. This standard for tangerines was

deemed necessary to stop packers from cooking them in the coloring room before they were mature, destroying all value of the fruit and paralyzing the market.

Since I am discussing tangerines, I will take up the discussion of tangerines for the proposed new bill following up with oranges and grapefruit. The new standard as provided and recommended by the Florida Citrus Exchange Legislative Committee and the Composite Committee of the State of Florida which is composed of two members of the Florida Citrus Exchange, two members of the Florida Citrus Clearing House Association, two members of the Chamber of Commerce of Winter Haven, two members of the Fruitman's Club and two members of the Committee of Fifty, making a committee of ten. This committee is composed solely of growers of citrus fruits who have labored strenuously to try to work out a fair and equitable standard of maturity that will be fair to all citrus sections of Florida. This committee recommends a new standard on tangerines of seven and one half to one, the season to close at midnight on November 30th. It is the opinion of members of the committee that the same conditions that prevail on November 16th last year will prevail on December 1st this year, providing this recommendation is passed. There are a number of larger tangerine growers in the state who believe the acid test in tangerines is not the right test; that tangerines should be picked for size and color, prohibiting the coloring artificially; that this will right the tangerine situation and I am informed that this recommendation is going to be submitted to the citrus committee of the Florida Legislature by some of the larger tangerine growers.

Before I discuss the standards of maturity of oranges, a factor to reckon with is the deadly arsenic spray and the applying of other forms of arsenic, which destroy the acid and likewise destroy the value of the fruit. It is hoped that the arsenical law can be enforced and the users of arsenic spray be prosecuted and penalized, by not allowing this fruit to go to market. There has been considerable discussion relative to what is the proper standard of maturity on oranges. Many recommendations are, that a solid content be provided in the standards, some as high as nine point with a ratio of sugar to acid of nine to one. If such a law was passed it would prohibit the moving of such oranges as the Parson Brown, Norris, and Hamlin, until after the expiration of the green fruit law.

The majority of the Florida Citrus Exchange Legislative Committee, which was approved by the Board of Directors of the Florida Citrus Exchange agreed that the present law with a ratio sugar to acid of eight to one was about as good as could be had until more complete data was gathered as to solids content of the juice as well as the juice content of oranges. It has been recommended to all associations in the Florida Citrus Exchange, that they keep accurate tests on all oranges during the period of the green fruit law for the next two years, to ascertain what would be best standard of solids or juice contents to set up for oranges. In making surveys in the various territories, oranges grown on sour stock carry high solids, while those grown on lemon root do not carry as high solids, but are as good in eating quality, if not better than those on sour stock.

Another matter before the committee was the question of keeping the illegitimate shipper, operator or packer from packing and branding seedling oranges as Parson Brown. This practice has been going on for many years, due to the fact that the seedling oranges carry a fairly high ratio during the month of November in many sections of Florida, yet with high solid contents in the orange test, we will find many seedling sections that will not be able to move any seedlings until the law has been lifted. After considerable discussion, and study the Composite Committee adopted the following on oranges, that is, an orange to be deemed mature for shipment must contain at least eight and one half per cent solids in the extracted juice and that the ratio should be eight to one which is the same as the old law with the exception that we are placing a minimum solids of eight and one half. After giving this considerable consideration the speaker is still of the opinion that we should have more data on the solid contents of juice than we have, in order to establish a minimum solid for oranges and therefore believe that the present law is about as good as we can get without causing any hard-

ships or catastrophe to the orange industry during the coming two years.

Next, we take maturity on grapefruit. From our experience from the past two years we all realize that the grapefruit law must have some changes in order to provide a more satisfactory eating quality fruit. The past season has demonstrated to me that a juice content requirement must be provided for grapefruit, yet I do not believe it is the time to eliminate the acid test. I come from a section that has always shipped grapefruit early. Before there was any green fruit law, I have shipped grapefruit fully colored before the first of September, and as stated previously in this paper color of the rind spells maturity. Yet under the law that is on our statue books today, relative to grapefruit, there is plenty of grapefruit that is fully colored that will not pass the required test and on the other hand there is plenty of fruit which is dark green in color and which takes from 72 to 90 hours in the coloring room, which will pass the test as provided in the law. Now do you believe that our present grapefruit law is adequate under these conditions? Yet in establishing a law that is favorable to all sections and that will improve the quality in reference to maturity of our grapefruit it has been a big problem for the various committees that I have been on to set up a standard that will meet the requirements and will give good eatable fruit to the consumer, and after all we must remember that the consumer is the judge of the maturity of our fruit.

Taking all facts and data that the Legislative Committee of the Florida Citrus Exchange could collect and had before them, certain standards were established by this committee.

The juice content approved by this committee was that recommended by Commissioner Mayo and his staff. Probably the juice content is low and could be increased twenty-five to thirty cubic centimeters to each size grapefruit, yet we find that this will eliminate sections like the Homestead section, due to the Royal variety grapefruit which has always been shipped from this section early, and is a good eating fruit, but due to the thickness of its rind would not meet an increased juice requirement. On the other hand many other sections had thin rind, full of juice, carried full color but did not meet the required solid content which is provided in the present law or recommended by others; therefore it was the opinion of the committee that the minimum solids in grapefruit should be reduced to eight and that the ratio on fruit between eight and nine in minimum solids to be deemed mature must have a sugar to acid of not less than six and one half to one, providing that it carries a juice content proportionate to its size. The recommendations of this committee were passed on to the Composite Committee and were approved by them without any changes. It is my opinion that this is about as good a set up that we can work out harmoniously in consideration of all sections and should put a far better eating grapefruit to the consumer than we have been able to do in the past.

I want to say further that Mr. Mayo and his staff have co-operated 100 per cent with the Committee in trying to work out a solution for the best interest of the industry, particularly the grower and the consumer, and as Mr. Mayo has expressed himself, the consumer must be satisfied before the grower can realize any profits on his investments. We all realize that the shippers are somewhat indifferent as their profits are always taken out before the grower gets his net returns. After reading the report made at the shippers' meeting recently, I was astounded at how little interest there was among them and how little the shippers knew about the green fruit situation as it is today; and the gist of that meeting was that it was more important to find out how early we could ship our fruit, than how we could ship good fruit early. Now on all the Committees with which I have had the pleasure of working, it was the object not to shorten the shipping season of our citrus fruit, but to try and establish the standards that would allow good eatable fruit to move when it was ready so that we could always have a satisfied consumer.

I have heard it expressed a number of times that no complaint was made as to oranges, but I disagree on this, for I have seen oranges on the market that were so far from eatable that the retailer had to discard them and they were not processed oranges, either. In talking with tourists this past winter as many complaints were

registered against immature oranges as there were against immature and ricy grapefruit. Yet I want to again repeat that more data must be obtained as to the question of maturity of oranges than we have at hand at the present time. I have spent the past two years in making tests, collecting tests, visiting packing houses early in the season before shipping early fruit, and I am convinced in my own mind that the recommendation as approved by the Composite Committee on grapefruit, will improve the eating quality of our shipments 100 per cent.

Motion made, seconded and unanimously carried that this green fruit legislation matter be referred to the legislative committee of the Horticultural Society for further consideration.

J. C. Morton: I wish to call your attention to the fact that we, in the State of Florida, are not yet prepared with sufficient evidence and scientific tests to go to the Legislature and know we are putting through a green fruit law that will be practical and serviceable to the industry of the State. I have served on most of those committees, and it has been alarming the amount of ignorance displayed, even by the Department of Agriculture, regarding maturity standards, and we are not yet in a position to present a bill that we know will fill the needs of the industry.

I want to call your attention to the present bill recommended by this so-called Composite Committee. As Chairman of that committee I want to state that the action of the Committee of Fifty in withdrawing its members' approval on the standard on oranges of eight and one half solids would be evidence that would indicate that they thought there should be other ways than placing that standard of eight and one half solids on oranges. There is no solid test, the present law simply having the ratio eight to one. My greatest fear is of the new recommendations on grapefruit. This present season was the first season since we have had a maturity standard in which the question of juice in grapefruit came up. That may not appear before us again for several years, but if it does, under the present law, as stated by States Attorney Davis, and others, Commissioner Mayo has the power under the law to prescribe and instruct or demand such juice standards as he may declare necessary. There is no necessity for this going to the Legislature for a change in juice standard, which we may not need for several years, and which, if we do need it, is in the power of Commissioner Mayo to change. Then the new recommended bill states the solids shall be eight and the ratio of solids between eight and nine shall be six and one half and one. The present grapefruit solid demands eight and one half and the ratio between eight and nine of seven to one. I wonder if any grower present feels the industry will be benefited by lowering the standard of grapefruit.

An investigation made by me and other members of the Committee of Fifty seems to indicate that under this new law the movement of grapefruit from the State of Florida during the inspection period may increase from twenty-five to fifty per cent, and if any one of you think that's a safe thing—I am a little doubtful personally, and I really think that as an industry we should at present continue with the law we have.

Commissioner Mayo this year has a surplus of $24,000 left over from the season's operations. I don't know what that $24,000 cost the State of Florida this year, but it's there, and I think we should demand that the Commissioner of Agriculture take this $24,000 and establish a real scientific laboratory that shall operate during the next two years, and give us sufficient data on which to go before the Legislature two years from now and demand a law that will be practical, serviceable and permanent. I believe the best thing for the industry of the State of Florida at present is to demand strict enforcement of the present law. It has done very well, and then demand that there shall be sufficient scientific investigation so that two years from now we may have a real law.

Clinton Bolick: I agree with Mr. Morton on the oranges, but there has been enough data compiled on grapefruit—over 1200 tests. We have classified it. There is the sour orange stock. Here is grapefruit that run in solids up around 10.90. The solution ran forty-seven, on acid 180, ratio six to one. The local requirements to pass that are five, five, five, one. The fruit was dark green in color, and the juice content very low. Is our law adequate to take care of a condition like

that? I wish I had the record of how many hours that fruit had to stay in the coloring room to get colored so it could go out.

Now on the lemon root fruit, the solids were 8.30; solution 31; acid 119; and the ratio was seven to one, with high juice content and high colored rind, and only a solid of 8.30. I tell you the color on your rind spells maturity, and you can't fix a law that will touch that issue. This Composite Committee, as well as the Legislative Committee of the Florida Citrus Exchange have taken this into consideration. We have worked for days.

I am surprised at Mr. Morton. Every person knows that law isn't right. It can't be. There was plenty of fruit that went out in houses where they cut twenty-three grapefruit to get enough juice to fill the little phial they made their test in, under the present law. There is yet plenty of fruit in the State, in Polk County and other places, on the trees, that should have gone out, and couldn't go because it couldn't meet the requirements of solids of eight and one half, showing two-thirds and one-half color, yet we were hauling in dark green fruit, because it had ten, eleven and up as high as twelve of solids. You say the law is right? It isn't right. It isn't going to be right until we get a test that is somewhere near where the rind is showing maturity.

I was up to the Legislature two years ago when Howey tried to put in a juice content in grapefruit. I have spent the last two years in collecting data to try to go before the Florida Legislature with a program I felt was right on grapefruit. You say why grapefruit and not oranges and tangerines. I am not an orange and tangerine grower; ninety per cent of my crop is grapefruit. I come from the early grapefruit section. The first car I shipped was the thousand twenty-first, yet plenty of grapefruit went although it wasn't fit to eat, because it carried high solid content, little juice, and was cooked to death in the coloring room; yet full colored fruit, hanging on the trees couldn't go because of the law. I am a grower of both types, sour and lemon root. For that reason, we are trying to get the eatable fruit to the consumer, and keep back the fruit that isn't eatable.

Mr. Waldron: You said you shipped the thousand twenty-first car. At that time Commissioner Mayo had established the juice content. You are proposing only raising it eighteen per cent; you are still too low on your juice. Everybody knows grapefruit was very dry this past year. I made tests the first of September in the ridge section, Polk County, in which the fruit failed to pass the present law. I had much more juice than required. You have lowered your ratio. You will have to do something to get edible fruit.

Mr. Bolick: You say green fruit. I say eatable fruit.

Mr. Waldron: If you haven't the juice, it isn't eatable. If it is only eighteen per cent higher than last year, it is not enough.

Mr. Bolick: As I said in my paper, we don't want to bar certain varieties that have always been shipped as early fruit. I don't think this law is perfect, but under the conditions that we have to labor, with the various soil conditions and root stock conditions and different localities, and our other conditions in which this fruit is grown, we have tried to set up the best we could set up without crippling any particular section. If you increase the juice content, your Homestead section will not be able to move until after the law is lifted.

Mr. Waldron: In order to protect growers of Royal grapefruit, is it all right to send thousands of cars of immature fruit from other sections? Isn't this law demoralized by people looking for their own interests rather than the interests of the State? I heard one man say he had heard no complaint about green oranges in Florida, yet the State was flooded with complaints.

Mr. Bolick: I think I covered that in my paper. There were some men on that committee who weren't harmonious with the present setup on oranges, and one man wanted seven and one half without any solids. He says "We will work out most anything you want on grapefruit," because he knew I was interested in grapefruit. We want good, eatable grapefruit, and I am convinced you have a good eatable grapefruit under that law, and because you have the juice content in there that will give the fruit a juicy flavor.

I was talking with th manager of Childs' Restaurant. He bought five carloads of grapefruit in one shipment. He had to go and buy a carload of canned juice to put over that grapefruit so people would eat it. We just want to get good eatable fruit to the consumer. You didn't hear a lot of complaint after Commissioner Mayo put the juice content requirement in there.

Mr. Hyde: I want to ask Mr. Bolick one question. I have talked with quite a number of packing house operators on this subject, and I have asked the packing house operator, under the present proposed law, how much fruit will be shipped in comparison to this past year, and in every instance they have said about twice. Under the proposed law, next year during the shipping season there will be twice as much fruit leaving the State as during the past year. Whether its green or ripe or edible is a question, but if that much goes out during that same period, I think our markets will be pretty well flooded.

Mr. Bolick: I think that the fruit that is eatable will move out, and the fruit that isn't, is going to stay in Florida under this present setup. It may increase or decrease. I will venture to say there are very few packing house managers in the State of Florida that have given any consideration to this green fruit law, or any fruit law. If it didn't pass, they told the grower it didn't pass, and told him to bring in another sample That's about the status of the packing house managers in Florida today. It has dug down into the pockets of the growers until they are beginning to think about it today, and as I have stated before, I have spent two years studying this thing.

L. B. Skinner: We want to extend our markets if we can safely do it. If we can ship grapefruit with enough juice in it in September, ship it. We are confronted with a condition here that we have a thirty million crop, about half of which is grapefruit, and that is going to increase every year, and 200 cars floods the market. If we can get off part of this before, I believe the recommendation of this committee will give us plenty of juice, and if we can get that off, we are that much better off. We certainly can't market twelve or twenty million boxes in a short time. You have got to have plenty of time to do it.

ENFORCEMENT OF THE PLANT QUARANTINE ACT

By Lee A. Strong, Chief, Plant Quarantine and Control Administration, U. S. D. A., Washington, D. C.

The Plant Quarantine Act which became effective August 20, 1912, was the culmination of several years of effort to have some type of legislation passed by Congress that would serve to protect the agriculture and horticulture of the United States from plant pests from foreign countries.

In submitting a report on this bill on May 6, 1912, the House Committee on Agriculture in the Sixty-second Congress outlined as conditions which called for this legislation the following:

"The United States is the only great power without protection from the importation of insect-infested or diseased plant stock. Referring only to European powers, Austria Hungary, France, Germany, Holland, Switzerland, and Turkey prohibit absolutely the entry from the United States of all nursery stock, and admit fruit only after a most rigid examination shows freedom from infestation, and most of the others have very strict quarantine and inspection laws and the same is true of the important British and other colonial possessions.

"The United States thus becomes a sort of dumping ground for refuse stock. Diseased livestock may be and are excluded by law but diseased and insect-infested plants have no bar against introduction. More than half of the important insect pests of fruits and farm crops are of foreign origin and these now occasion a tax of nearly half a billion dollars annually. A properly enforced quarantine and inspection law in the past would have excluded many if not most of these insect enemies and also many plant diseases."

The Committee further said:

"While as just indicated most of the important seriously injurious insects and plant diseases

which are now levying an enormous yearly tax on agricultural productions, have been introduced from foreign countries, there are still many other insect pests and plant diseases which may be excluded. There are important orchard and fruit pests in Europe and Asia, the entry of which can be guarded against. There is also just now a special danger from introductions from Asia where conditions are little known and where pests are very apt to be new and unusually destructive."

After referring to a number of serious pests which had been brought into the United States in the absence of any quarantine regulation, and indicating something of the damage which had followed these introductions, the Committee said:

"Many of the plant diseases and insect enemies of the old world now established in this country could undoubtedly have been excluded and thus would have given this country a tremendous advantage for a long period in augmenting the quantity produced and lessening the cost of production. The past cannot be altogether remedied but the future can be safeguarded and this act would go a long way toward accomplishing this end. With the exception of importing nurserymen there has been practically universal demand for this legislation. The Horticultural Societies of many States have demanded it and have come solidly to its support."

Following this favorable committee report, the Congress of the United States passed the bill and it became a law in August, 1912. It is of record that since the passage of the Plant Quarantine Act, but three major horticultural and agricultural pests have become established in this country—the Mexican fruit fly, which came across the Mexican border and heavily infested the citrus orchards of the Lower Rio Grande Valley of Texas, but which has apparently been completely exterminated, no infestation having been found during the past two crop seasons; the pink bollworm of cotton, which likewise came into the United States from Mexico, and which has been exterminated over large areas, but which still exists in serious form in the cotton fields in the Big Bend area of Texas, in a modified form in certain areas in New Mexico, and in the Salt River Valley of Arizona; and the Mediterranean fruit fly, which was found in Florida two years ago but which has been so successfully fought that only three very minor infestations have been found since August, 1929, one in November, 1929, one in March, 1930, and the last, July 25, 1930.

In contrast to this condition it seems important to point out that in the few years immediately preceding the passage of the Plant Quarantine Act, there came into this country such serious pests as the European corn borer, the chestnut blight, the Japanese beetle, the white pine blister rust, citrus canker, the alfalfa weevil, the oriental fruit moth, and others of similar destructive nature.

Referring again to the report of the House Committee on Agriculture, of May 6, 1912, one sentence will bear repetition. "There is also just now a special danger from introductions from Asia where conditions are little known and where pests are very apt to be new and unusually destructive." Two of our most important introduced insect pests had undoubtedly been brought in from the Orient just prior to the passage of the Plant Quarantine Act, but had not been discovered when the committee made its statement. We know the oriental peach moth came to us from Japan. We know it came in on that beautiful plant, the flowering cherry, which is even now in its full glory of bloom on the driveways bordering the Potomac in Washington. There is no more gorgeous sight in any horticultural setting in this country. Many thousands of people enjoy the beauty of the plant and its bloom. What of the pest, the oriental peach moth, that the flowering cherry brought us? It has now spread to twenty-five States and presents a real problem in control. Again, the Japanese beetle brought from Japan in iris roots in soil during the few years prior to the placing of restrictions on the importation of plants from abroad presents another tremendous problem. Had there been any quarantine regulation in effect at eastern ports of entry when these importations were being made, soil would have been excluded and this pest would have been prevented entry. The Japanese beetle is a troublesome and discouraging pest, now present in nine States and the District of Columbia. In a circular (No. 180) issued by the Bureau of Statistics and Inspection of the

New Jersey Department of Agriculture in January, 1931, there appears the following foreword:

"The Japanese beetle (*Popillia japonica, Newm.*) has become an insect of economic consequence to the States in the New York and Philadelphia metropolitan areas and is of considerable concern to the rest of the country. This circumstance has evolved because of the costly and annoying depredations of the insect, while uncontrolled, on economic and ornamental plants within the heavily-infested area and the subsequent alarm arising in non-infested states in anticipation of an invasion by this destructive insect, which they believe inevitable.

"The very discouraging experiences of those who were interested in the growing of susceptible vegetation in the Riverton area during the early American days of this insect will stamp it as an insect of great potential destructive capabilities. However, the recent improvements in spray mixture formulae, more widespread spraying for foliage protection and lawn treatment for protection against the grubs, more extensive use of traps, and the successful establishment of many parasite colonies have reduced the beetle population, even in the heavily-infested area, so that satisfactory protection readily can be realized. In fact, the periphery of beetle advance represents today the most troublesome phase of the control work, principally because of the local novelty of the insect and the erratic use of control measures. A prediction that the Japanese beetle will, within the next ten years, be shifted from the class of insects of major economic importance to the one of minor economic importance is not believed to be too optimistically visionary."

It is to be everlastingly regretted that the Plant Quarantine Act was so long delayed in passage because some of our present ills could have been avoided.

What is the Plant Quarantine Act? It is not a mere authorization granted by Congress to enforce certain regulations issued under that act. While the Secretary of Agriculture is of necessity given certain discretion in the placing of regulations, the Plant Quarantine Act is in fact a mandate issued by Congress to the Secretary of Agriculture.

The Act provides among other things, that it shall be "unlawful for any person to import, or offer for entry into the United States. any nursery stock, unless and until a permit shall have been issued therefor by the Secretary of Agriculture under such conditions and regulations as the said Secretary of Agriculture may prescribe." It is further provided that "Whenever in order to prevent the introduction into the United States of any tree, plant or fruit disease or of any injurious insect new to or not theretofore widely prevalent or distributed within and throughout the United States, the Secretary of Agriculure shall determine that it is necessary to forbid the importation into the United States, of any class of nursery stock, or any other class of plants, fruits, vegetables, or other plant products from a country or locality where such disease or insect infestation exists, he shall promulgate such determination, specifying the country and locality and the class of nursery stock or other class of plants, fruits, vegetables, or other plant products which in his opinion should be excluded. Following the promulgation of such determination by the Secretary of Agriculture and until the withdrawal of the said promulgation by him, the importation of the class of nursery stock, or other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products specified in the said promulgation from the country and locality therein named, regardless of the use for which the same is intended, is hereby prohibited."

A further provision is that "the Secretary of Agriculture is *authorized and directed* to quarantine any State, territory or district of the United States or any portion thereof when he shall determine that such quarantine is necessary to prevent the spread of a dangerous plant disease, or insect infestation, new to or not theretofore widely prevalent or distributed within and throughout the United States."

The Act contemplates therefore that the Secretary of Agriculture shall prescribe rules and regulations under which nursery stock may be safely admitted into this country from abroad. It contemplates further that if it is necessary in order to prevent the introduction of plant diseases or insect pests into this country from abroad, to forbid the importation of certain products into this country, that that shall be done. With respect to

the placing of quarantines within the United States, the Secretary of Agriculture *is not only authorized but directed* to quarantine any portion of the United States when such quarantine is necessary to prevent the spread of a dangerous plant disease or insect infestation. That this is not hasty or ill-considered legislation, is evidenced by the fact that the bill was passed by Congress only after twenty years of effort. The first bill introduced in Congress for the prevention of spread of disease through the transportation of plants was introduced on January 15, 1892. Several successive bills were introduced but none became law until August, 1912, when the Plant Quarantine Act was passed.

Under the terms of the Plant Quarantine Act the Department has undertaken the responsibility of preventing the entry into this country of injurious plant pests. Obviously, a reduction in the volume of importations of plants proportionately reduces the risk of pest introduction. Therefore, in order to carry out the purpose of the Act the Department has found it necessary to limit the importation of plants from abroad to those which are necessary to the propagating needs for the horticultural development of this country. Certain rules have been laid down under which plants may be imported. Criticisms have naturally resulted on account of the restrictions, one of which is that in the issuance of permits the amateur plant grower is being discriminated against in favor of the commercial nurseryman. Under present conditions amateurs may import plants when the person is widely or nationally known as a specialist in, or as maintaining a fairly complete study, or experimental collection of some special class of plants as roses, dahlias, etc.; by any person who is maintaining a notable general collection of plants of the nature of a botanic garden or arboretum which is freely open to the public and which serves a distinct educational purpose. Permits are also issued to botanic gardens, agricultural colleges, experiment stations, and other similar public institutions to meet necessary experimental, educational, or scientific need.

It may be that the restrictions on the importation of plants by amateurs could safely be liberalized in some measure. If there is to be regulation of the entry of plants to prevent the indiscriminate importation of plant pests, there must be some rule which may be followed with justice to all in order that the purpose of the law may not be completely lost sight of. It seems reasonable that the State Horticultural Societies might well assume part of the responsibility for determining who, as amateurs, would be eligible to receive permits for the importation of plants from abroad. There is no disposition on the part of the Department to curb the desires and activities of the amateur plant grower, for the development of horticulture that has resulted from the efforts of the amateur is well understood and is applauded. The Department will welcome any suggestion which the Horticultural Societies of the country can develop, having for its purpose, if it is possible to work it out, a more logical, perhaps more uniform basis upon which permits may be issued for the importation by individuals of plants from foreign countries. Naturally, such a program must not in any way be permitted to increase the risk of pest introduction. There must be kept in mind at all times the purpose of the restrictions, which is to prevent the entry of injurious plant pests.

Accepting the mandate issued by Congress, the Department has undertaken to regulate entirely the importation of all plant products from abroad that might through the introduction of pests menace the agricultural and horticultural production of the United States.

In addition to the regulation of nursery products, a port inspection service has been set up. This service not only undertakes to inspect and pass or reject the commercial shipments of plant products offered for entry, but also prevents the bringing in of incidental or casual lots of plant products which are frequently much more dangerous than the commercial importation. There are at the present time inspectors located at all the principal ports of entry in the United States, including the ports of entry along the Mexican border and at strategic points along the Canadian border. At the Mexican border ports of entry during the fiscal year ending June 30, 1930, there were intercepted 26,100 separate lots of plant products prohibited entry into this country from Mexico by quarantine. At the maritime ports of entry there were inspected 21,058 ships from for-

eign countries. There were intercepted at these maritim ports of entry 18,609 lots of contraband plants and plant products. The building up of a port inspection service to the point which would permit of the proper inspection of commodities offered for entry and which would likewise permit the proper inspection to intercept those products that are brought into the country through ignorance or carelessness or through design to circumvent the quarantine laws, has been a slow process. Men have had to be trained. Transportation company employees have had to be educated to the importance not only of complying with the regulations but of assisting in their enforcement. Without the aid of the transportation companies, freely given, the work could not have been so successfully performed.

While Congress has been generous in making appropriations, the very nature of the work has been against speed in building up the service, due to the obstacles met in the securing of properly trained and qualified men and making arrangements for proper supervision. We have not yet reached the point where we can say that the service has assumed satisfactory proportions. The efforts of the Federal Government have of necessity been concentrated toward the taking care of those ports where large lots of material are offered for entry which have a wide distribution throughout the counry. There are certain sections of the country which are much more exposed to danger of pest introduction from abroad than are these ports which receive products for wide distribution. Florida and California are notable examples of this condition. While much material reaches the ports in these States for ultimate distribution to other parts of the country, on account of the type of horticultural and agricultural production, and on account of favorable climatic conditions, these particular localities are more susceptible to infestation by a greater range of pests than are other sections of the country. While it cannot be disputed that this makes the protection of these ports essentially a national problem, it is by the same token true that the problem becomes one of at least equal local or State interest.

The introduction and establishment of foreign pests in these States is of primary consideration and of primary importance to the two States concerned. Realizing this, and with every desire to co-operate in the building up of a real national plant quarantine inspection service, the States of Florida and California have maintained almost entirely at State expense the inspection service at the ports of entry in these two States. The inspectors all act under Federal authority as collaborators of the Plant Quarantine and Control Administration. Certainly until the service is built up over the United States to a greater degree than it has been possible to build it up to this time, it is to be sincerely hoped that Florida and California will continue to make this contribution to the plant quarantine work, which is not only of national interest but which first of all is of interest to the respective States.

Florida has experienced, as have few other states, the difficulties and expense which follow the establishment of injurious plant pests within the State. Two major plant pests have within the past twenty years found lodgment in Florida, and so far as is known neither pest at this time exists within the State of Florida. This is due, more than any other one thing, to the fact that there has existed in the State of Florida, an organization able and in position to immediately cope with situations of this kind. If there had been in the State of Florida no such organization as the State Plant Board or if there had been such an organization manned by a less able, less energetic personnel than the Plant Board of this State, it is entirely probable that both citrus canker and the Mediterranean fruit fly would have persisted much longer in the State than has been the case. Under any circumstances success would have been impossible without the splendid assistance which has been given by the growers, shippers, and associations of Florida.

The Plant Quarantine and Control Administration has enjoyed the hearty co-operation and assistance of the officials of the State of Florida, particularly the Governor and the State Plant Board, and of the agricultural organizations; certainly of the State Horticultural Society; and since all are working for a common good—the protection from pests in the development of the agricultural and horticultural industry of the country—this co-operative effort should continue.

PLANT MOVEMENT THROUGH AIR TRANSPORTATION TERMINALS

Dr. J. H. Montgomery, State, Plant Board, Gainesville

I know that you have all listened with the keenest interest to the discussion on plant quarantine from the national standpoint, as presented by Mr. Strong. I know of no more capable or able man to discuss that subject than the Chief of the Administration.

It is now my intention to discuss, in a very brief manner, plant quarantine from the State aspect. It is true that I am on this program to speak on the subject of air transportation and its relation to plant pests, but if you will permit me to do so I want to sketch a background or, if you will permit me to change the metaphor, lay a foundation for that particular subject. Most of you doubtless think plant quarantine is something of comparatively recent origin. I want to disabuse your minds of this idea. Plant quarantine is one of the most ancient procedures of which we have any record. Those of you who are familiar (and I assume most of you are) with that sacred classic, Genesis, will remember that there was a certain tree which was placed under quarantine and the removal of fruit from that tree was prohibited. There was a penalty attached to the violation of that quarantine, and the penalty was enforced. That's the first record we have of plant quarantine, and it's a good record.

In our times, the subject of plant quarantine was brought to the attention of those interested in agriculture and horticulture by reason of the introduction into this country, on shipments of imported plant material, of certain foreign diseases and insect pests of considerable economic importance. The necessity for the protection of the industry was realized, and through the efforts of a few interested individuals the Federal Plant Quarantine Act was passed in 1912. This Act gave to the Federal Department of Agriculture the right to regulate the importation of nursery stock and other plant material from foreign countries, and to prohibit the entry of material from areas where certain serious pests were known to be prevalent. Prior to the passage of the Federal Plant Quarantine Act, the Californians had appreciated more fully than the rest of the country the necessity for plant protection, and had already enacted legislation looking to the safeguarding of the state's agricultural and horticultural interests. In 1915 Florida, which prior to that time had had very little in the way of plant protection legislation, enacted the Plant Act. This was forced upon the agriculturists of the state by reason of the calamity threatening the citrus industry through the introduction of citrus canker.

With that slight background I want to come up to more recent years. Plant quarantine fifteen years ago, or ten years ago, was a relatively simple proposition. Since that time transportation has rapidly advanced. Good roads and motor transport have developed. Fast steamers with refrigeration facilities bring foreign countries closer to us. Interstate quarantines are extraordinarily difficult to administer; foreign quarantines are difficult to handle because of the ease with which transportation can bring foreign materials to our ports.

Some three years ago, there began a development here in Miami which has had great influence upon plant quarantine; that is, the opening up of the International Airport, which brought foreign countries, foreign interests, foreign products and foreign pests infinitely closer to us than they had been theretofore.

I have given you a lesson in history. I am going to give you a lesson in geography now. We present this map which we have prepared. I want you to know the relationship which Florida bears to the tropics, Mexico, all these countries bordering on the Caribbean, the Gulf of Mexico and the northern part of South America, which latter, incidentally, from a plant pest standpoint is an unknown land. All of these countries have now been linked to Florida by a network and chain of air plane lines. You will probably be surprised when I tell you that that network con-

sists of some 22,000 miles of airways, and there are being operated on that network some 140 planes. Today, Miami is two hours flying time from Havana, only a few hours further away from Haiti, only a few hours further away from Panama, and all this territory around the Caribbean and the Gulf of Mexico has been brought within a day or so of Miami. What does that mean, now, to you, as horticulturists and agriculturists, and what does it mean to us who are engaged in affording protection against the introduction of foreign plant pests? It means the dangers to which you are exposed are greatly multiplied. It means our duties are greatly multiplied. There was a time when we could get along fairly well with a few men at a port like Miami. We had to handle a certain number of passengers coming in by steamers, a certain amount of freight traffic coming by steamers, and a certain amount of plant material. Now with the development of rapid transport that has all been greatly increased. Let me take as an illustration the volume of our business (I use the word "our" advisedly, because it is our business) which the plant quarantine officers at Miami had to handle during the last month, that is, the month of March. I am not going to trust my memory. I have made a notation. Last month the total number of passengers coming into Miami from foreign ports was 7,791, and approximately twenty-five per cent of that volume of passenger traffic came by airplane. Each one of those passengers was a potential carrier of fruits, vegetables, flowers, and small plants, each one of which might carry plant diseases or insect pests. In that twenty-five per cent (I am going to refer to it again) those passengers carried 17,300 pieces of baggage, each one of which had to be handled and inspected by the Custom service and the plant quarantine service. Again we have the twenty-five per cent. In this instance (it is just one per cent above twenty-five per cent) twenty-six per cent of the baggage was transported by the airplanes.

What was the object in inspecting this material? I have told you that. What was the result of the inspection work? Again, we are going to deal in percentage. During the month of March our inspectors made forty-one interceptions of material which was infested with major pests. When I say "major pests" I am not referring to common pests, such as have already been introduced, and established, such as the purple scale, whitefly and so on, but I am referring particularly to two major pests which have not yet gained entry into the United States, and both of which are knocking at our doors. One of these is the blackfly of citrus, a close relative to our common whitefly, but with a wider range of host plants and doing greater damage than the whitefly has ever done. The other pest is the green scale, with an equally wide range of hosts, and doing great injury and damage to the hosts which are affected. Forty-one times passangers or passengers' baggage carried material which was affected by those pests. Forty-one times your employees, your hired men, protected you from the introduction and establishment of these pests. Again we have the percentage—twenty-five per cent of those interceptions were made on material arriving by plane, and I ask you is it worth while?

Now what of the future? It has only taken three years for the building up of this airplane business in Miami. The Pan-Amrican Company has invested in this landing field out here for landing planes some $700,000. It is now planned to expend another $700,000 in the development of a sea-plane base at Miami. They are operating large planes which carry as many as twenty passengers. We have it, on most excellent authority, that they are planning to utilize planes which will carry twice that number of passengers. I have it from rumor and report that it is not impossible that the hundred-passenger plane will within a few years be in service. I have it on reliable authority that whether the Pan-American Company does it or some other concern does it, there will be a huge mooring mast built at Miami and dirigibles operating into this port.

If the same ratio that I have indicated to you continues, then our problem becomes just that much greater. The exposure is there—all through the West Indies, all through this chain of islands where the blackfly is firmly established.

Over here (Mexico) is the Mexican fruit fly. Through this area (north coast of South America) there are pests of which we know nothing.

At this point (Bahamas) and here (West Indies) and here (Panama and other Central American countries) the blackfly is firmly established. Here (Cuba) is the green scale, and almost everywhere throughout this area are the fruit flies.

What is the answer? That's not a problem in mathematics. I have given you a lesson in history and your lesson in geography. In mathematics and arithmetic I will leave it to you; you can figure it out for yourselves.

The United States Government has been doing, and I know it will continue to do all that it is able to do in the way of affording protection. The State Government has in the past generously contributed to the protection which you have reason to expect, and which you should have. Whether that is to be continued by the Federal Government or State Government, or by all, is in the laps of the gods, and in the hands of the interested individuals.

Session at Country Club, Homestead, Fla. April 17, 1931

ADDRESS OF WELCOME

By A. R. Livingston, Homestead

It is always a pleasure to welcome our guests to this territory. This pleasure to me is unexpected. You were to be welcomed by our mayor, S. E. Livingston, who, I am sorry to say is no relative of mine, though we do bear the same name. He was obliged to be in Miami today, and asked me to take his place. I am going to try to make the welcome no less cordial, although I think he could have done it in more fitting words than I will.

Your chairman has a gavel there, and from the way he spoke I want to be very careful of what I do say to you lest he use it, as he threatened.

We are mighty glad to have you with us today. We are glad that Mr. Gray has sent us a fairly decent day for you to enjoy. We hope you have enjoyed it so far, and that during the afternoon you will see many more things that you will enjoy, at this your Forty-fourth meeting. We further hope that some day in the not too distant future, you will come again, when we will have something in addition to groves and forest trees to show you. We hope then to be able to take you through the Everglades National Park. Again I say we are glad to have you with us, and thank you.

RESPONSE TO THE ADDRESS OF WELCOME

L. B. Skinner, Dunedin

It wouldn't be hard to respond to an address of welcome to Homestead; it wouldn't be hard to respond to an address of welcome to any place around Miami; for I tell you, you have the goods down here. You have the people, and we are mighty glad to be with you.

Chairman S. F. Poole: You know Homestead, in a very large way, has made Horticultural history in Florida. There isn't a one of us but what has memory of and a feeling of reverence for a man who has grown up among you. I refer to the late W. J. Krome who for many years was very active in our society—and who was a leader in citrus and sub-tropical fruit industries in Florida, and it is in honor of him that we have come here today. His with that of Dr. Hiram Bird are names written in large letters across the paths of history, and when we come to a section such as this, it always does stir in our heart a great feeling for what has been accomplished and what was given birth in this district.

Right in your own neighborhood—right in the suburbs—you have the wonderful Chapman Field, with its great possibilities in the way of plant hybridization and specialization. I wonder how many of us realize what they grow, and what an important factor it is going to be in the development of our horticulture. It has been my privilege to go through it today, and I have never realized to the fullest extent what it meant before. I hope every one of you may take an oppor-

tunity sometime or other to see what they have there, what they have done in the past few years. It is remarkable the way Chapman Field has developed. Its possibilities in the years to come can hardly be estimated.

You have another institution here in your midst that is going to prove to be an important factor in your horticultural interests. I refer to the Subtropical Experiment Station. It is just being established, but it has a good personnel among its workers and I predict a brilliant future for it.

SUBTROPICAL FRUITS

H. W. Johnson, Homestead

I am by no means a perfect speaker, but I can do a mortal sight of talking. You are going to see our groves, and I shall take great pleasure in showing you what we are growing.

We are growing all the major tropical fruits except two varieties, Mangosteen and Durian, and we *will* grow them. We are growing over 200 different tropical and sub-tropical fruits. But the bulk are tropical fruits.

When we came down here twenty years ago, we couldn't grow anything but grapefruit and tomatoes. We didn't even grow orange trees. I was always a digger along certain lines. I was in the hardware business for forty years. I knew when we came down here that other things could be grown. In the first place, wherever a coconut grows many of the things that the Lord made in the Tropics will grow. I also knew that the finest fruits that can be grown on earth are grown in the extreme northern limits of this zone.

We are hardly eighty miles by airplane from the Tropic of Cancer. Homstead's latitude is 25 d. and 15 m. 600 miles south of the lower tip of San Diego County, California, and 280 miles south of Cairo, Egypt, and Morocco. Homestead's latitute around south of then will split Arabia, through the center, and India, through the center, where all these things grown. We have had tremenduous success, and we have some orders as far as two years ahead on our shipping books.

Now we grow not only tropical fruits, but we are growing many of the economic perfume, drug, cosmetics and other plants. We have made some wonderful discoveries. We have a tree that produces a paper pulp, that can be grown in two years time; and it also makes a wonderful boxwood timber for tomato crates. That means a whole lot here. They don't buy them here by the carload, but by the trainload. They have to have enough to crate eight to ten million dollars worth of tomatoes. The price of crates has advanced over 150 per cent since we came here. This tree is at home on our coral rocks, and wonderfully adapted to its home in the muck and in the salt marshes of Cape Sable. It grows in the Miami sands. It will grow right along the Seaboard. It is hurricane proof. It withstood all these violent hurricanes we have had, with only one limb off an immense tree. We have one tree that has had no special attention; it gets what fertilizer the other trees have, that calipers twenty-nine and three-fourth inches, four feet from the ground, just turning ten years old. The pulp wood men have gone wild about this tree.

We had a letter a few weeks ago from Senator Murphy, and he says he introduced a bill in Parliament to cut out the importation of pulp to the United States. They are cutting this pulp timber in Northern Canada, where he says it takes from 100 to 150 years to make eight-inch spruce. We are making those trees in 12 months.

We have various other economic plants. One of them is the Corsican Citron of which we are importing millions of dollars worth. It will grow anywhere. There are three groves here in this community. One is just coming into bearing. A banker from East Medford, Mass., has a grove just coming in, and it is worth about eight times the price of grapefruit. It is good for candy. They claim it takes seven million dollars worth just for Christmas fruit cakes, mince pies, etc.

I will not tire you any longer. You are going around to our groves in a few minutes, and we will show you our trees growing and fruiting.

Member: What's the name of the pulp tree?
Mr. Johnson: Albizzia Lebbek. (Lebbek-tree Siris-tree. Woman's-tongue-tree). It is a tree from Egypt. The seed was brought here by Dr. David Fairchild, the World's greatest plant explorer, in his pant's pocket. The seeds were picked up on the streets at Cairo twenty-five years ago.

A FUTURE FOR SMALL TROPICAL FRUITS

Charles H. Steffani, County Agent, Homestead

Horticulturally has South Florida taken advantage of the opportunities that have been placed before us? Through the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture, practically all of the world's tropical fruits have been distributed into South Florida. It seems almost a calamity that at least our door-yards should not be filled with a great number of the tropical fruits, that are useful for home consumption if not commercially.

By door-yards, I do not mean a fifty-foot lot with a house on it, although such places are alright for a few rare palms and flowering plants or shrubbery. Throughout the Southern part of South Florida, there are homes where from five to twenty-acre groves of citrus or avocados and mangos are growing, where ample space around the house is available for a great variety of tropical fruit trees such as Achras sapota (Sapodo-dilla), the chicle tree of Mexico. This handsome tree with brown fruits the size of apples and consistancy of brown sugar are certainly in demand on the local markets. Others are:

Casimiroa edulis (White Sapote) from Mexico and a distant relative of the citrus family. The green fruit of the size of a large apple with a bittersweet flavor when ripe, has only to be put before the public to find a ready market.

Lucuma Nervosa (Egg-Fruit) is a small handsome tree with fruits the size of a peach and consistancy not unlike the yolk of a hard boiled egg.

Eriobotrya Japonica (Loquat) a small handsome tree commonly called the Japanese Plum. It is not unknown to a good many, but few seem to be planted, at least not enough to be noticed greatly on local markets.

Spondias Cytherea (Otaheite Apple) a tree with clusters of golden yellow apples, good for making pies or preserving.

Tamarindus Indica (Tamarind) a tree bearing a cluster of fruits with astringent flavor used for making a refreshing drink.

Macadamia Ternifolia (Queensland Nut) a handsome foliage tree from Australia, bearing a good sized one kernal nut with hard shell and flavor not unlike the Brazil nut.

Melicocca Bijuga (Spanish Lime) a small fruit the size of a plum with edible acid pulp covered with a thin shell, cultivated throughout the West Indies, and South America, for its edible fruits.

Myricaria cauliflora, Garcinia livingstonii, Averrhoa carambola, Litchi chinensis, Blighia sapida, Ceratonia siliqua, Cecropia palmata, and other useful fruiting trees that would be useful for preserving or as fresh fruit eaten out of the rand.

The well known fruiting shrub or small tree, Annona squamosa (Sugar Apple) and annona hybrids are certainly deserving of more attention when its delicious fruits are in demand on the market.

Carissa Grandiflora (Natal Plum). This beautiful shrub with sweet scented star like flowers and handsome sub-acid, red fruits that make excellent jelly, resembling raspberries and sauce not unlike cranberries is deserving of a space for a hedge around anyone's place.

Eugenia jambos (Rose Apple). A tree or large shrub with yellow fruits two inches in diameter, suggesting the flavor of crushed roses, used for preserving or candied.

Eugenia uniflora (Surinam Cherry). Its dark evergreen foliage and showy red fruits are useful for jellies, jams or sherberts or delicious to eat when thoroughly ripe.

Flacourtia indica (Governers Plum). A large shrub or small tree bearing sweet black plums like edible fruits, good for jelly making.

Strychnos spinosa (Kaffir orange or natal orange.) A large shiny green leaved spiny shrub, bearing hard shell green fruits the size of oranges, the pulp being used to make an astringent drink, and large flat seed, containing a form of strychnine.

Punica Granatum (Pomegranate). An ornamental shrub with scarlet flowers and large red fruits with small seed, and red acid pulp; eaten out of hand or for making a refreshing drink. The rind contains tannin, and is used in the manufacture of Morrocco leather.

I might go on and mention numbers of others that are fruiting plants such as Monstera deliciosa, Eugenia, Zizyphus mauritiana, Carissa Carandas, Antidesma Bunius; and not unmindful of the fact that as well known as the papayas and guavas maybe, we certainly should have more planted.

We should not overlook the great variety of ornamental trees and shrubs that could be planted. We of South Florida pride ourselves on living in a Tropical Country. Why not have the Southern part of this great state a real tropical Aboretum, so that the future generation, who, not far in the future, will be taught tropical horticulture in the University of Miami, and in the University of Florida will have the benefit of seeing the rare plants of the tropics and point with pride at the far sightedness of their forefathers in getting these plants established for their education.

THE SUB-TROPICAL EXPERIMENT STATION

H. S. Wolfe, Associate Horticulturist in Charge, Subtropical Experiment Station, Homestead

When the genial Secretary of this society, Mr. Bayard Floyd, asked me to make my bow to the horticulturists of the state even at so early a date after my arrival in your midst, I thought it hardly proper for me to do so in the guise of one speaking with authority upon your problems. In as much, however, as the station which I represent is of equal newness with myself, and since we both hope to be able to render real service to horticulture, it seemed to me that I might profitably introduce myself to you by introducing the station.

Those of you who are already familiar with this region do not need to have pointed out to you the reasons for the establishment of a new station here, and those of you who have motored down from Miami today will not need much explanation of the peculiar need which it fulfills. The unusually tropical nature of the fruits grown in southern Dade County would almost be sufficient reason in itself for having a station here. For none of the older stations are situated where the climate will permit investigating these plants under field conditions. But even if this climatic barrier did not exist, the soil conditions existing here are so different from those found anywhere else in the state that work done elsewhere—even on the same plants—would be of little value for application here.

You will recall that we have two quite distinct soil types here in close proximity, and both widely different from the soils found anywhere else in the state. One of these is the so-called "pineland," an oolitic rock covered with a thin mantle of reddish soil which gives the name to this Redlands district. This is the soil type on which the groves are planted almost exclusively, and is marvelously productive of fine fruit in spite of the forbidding appearance of the substratum. After seeing some of the fine grove land hereabouts, you can easily understand the feelings of a California horticulturist who visited here not long ago. After being shown the groves and seeing the soil which produced them, he was driven down to the Keys for a look around. And seeing there a huge block of quarried coral rock, loaded on a gondola car for transportation, he asked, "Where are they taking that to farm it?"

The other type of soil is our "gladeland," a calcareous marl of several feet in thickness overlying the limestone rock. This soil lies low and is used almost wholly for growing truck crops. It shares with the pineland only its high calcareous content and its consequent high alkalinity. And both offer horticultural problems which could hardly be solved except by work done in this district.

The origins of the establishment of the station itself are not easy to trace definitely. It did not develop suddenly, but over a period of years, as the need for its existence became increasingly evident to many different people. So I can indicate only a few of the steps in the consumption of the idea. By the middle of 1928 the Director of the state experiment stations was seriously contemplating the establishment of a station in this district, recognizing the peculiar needs obtaining here. About this time also local sentiment had crystallized as to the need of experimentation and research on the problems confronting growers here, if progress was to be made. Under the aggressive leadership of Frank Rue, then President of the Homestead Rotary Club, and LaMont Graw, editor of the Homestead Enterprise, the Redlands growers began to consider how they could obtain some kind of research station.

It was largely through the mediation of that horticultural leader, the late W. J. Krome, that the efforts of state authorities and local organizations were co-ordinated. With the possibility of a state experiment station as their goal, the local committee wrought mightily to have sufficient evidence of local appreciation of the need so that the legislature might feel justified in establishing another station. Mr. Krome, together with Mr. C. E. Schaff, offered forty acres of excellent pineland for the station grounds. The committee obtained donations of twenty acres of well-drained gladeland in the East Glade area from the Miami Land & Development Co., and thirty acres of "tomato" gladeland in the Highlands area from the Model Land Co. Thus the station would have all the important local soil types for its experimental plantings and studies. Substantial discounts were offered by local business houses on all purchases of materials for the station. The county authorities were also approached and persuaded to provide funds for scarifying the pineland and erecting a substantial laboratory building.

With this co-operation of the state experiment station, County Commissioners, and local growers and business men, the bill providing for the establishment and maintainance of the Sub-tropical Experiment Station was submitted to the legislature in 1929 and was approved. It is only fitting to acknowledge the great assistance rendered in this connection by State Senator Watson and Representatives Chapple, Robineau and Young. The fruit fly campaign, however, tied up the experiment station authorities so that plans for the new station had to be left incomplete for some months. And it was only in the early part of last year that work was actually begun. By June of 1930 twenty acres of pineland had been scarified and the laboratory building was almost completed. I hope that many of you will take the opportunity this afternoon to see what a fine job the county did for us in that building.

You have seen that the station can hardly be said to have existed at the time of your last annual meeting, and it was only last fall that any experimental work was begun. Even yet we have not been able to do much more than lay plans and make preliminary studies. But I can indicate to you something of our hopes for future development.

The fertilizer practices of the growers of avocado and citrus fruits—and there are not even any practices in the case of the other fruits—rest on no experimental basis whatever, but only on the opinion of the individual growers. So many widely different fertilizer practices under apparently very similar conditions cannot all be right. But we know nothing of what happens to fertilizers when applied to this rock land. What portions are leached out? What are held by the soil in unavailable form? What are temporarily absorbed for future use? What are taken up by the tree? Until we have some quantitative evidence on these and many kindred phases of the problem, our fertilizer practices must necessarily be haphazard. We need to know from carefully controlled experiments carried through several years what the effects of using various sources of N, P and K are on these soils. And we are

far from having that desired cover crop which shall furnish a maximum amount of organic matter for these sadly deficient soils, and at the same time give a green cover for fire protection during the dry winter.

The truck crops are in a little better position than the tree fruits as regards fertilizer practices, thanks to the splendid work of Skinner and Ruprecht and their collaborators. But while their demonstration of the tremendous value of manganese as a soil amendment for glade soils is a noteworthy contribution, the highly variable nature of their data on the effect of different fertilizer ratios for the two years of their study shows that only a beginning has been made. And we know nothing of the amount of leaching or of residual effect of the fertilizers we apply. Other elements than Manganese, which the plant needs only in minute quantities, may prove to be lacking or unavailable in our soils. And leguminous cover crops may have a large role to play in the building up of a more permanent fertility on the glades.

When we consider the matter of varieties of fruits, we find again a field for long and patient endeavor. Twenty years of avocado growing have seen great improvement in the varieties, but we are still far from having what we feel to be ideal varieties. Even less work has been done on the mangos, although the Haden stands as a definite achievement there, and many of you are aware of the splendid work on mangos carried on by Mr. Simmonds at Chapman Field. In the case of the minor tropical fruits—guavas, the various annonas, sapodilla, surinam cherry, jujubes, and a host of others—we find an untried field both as to varieties and culture. Root-stock studies are badly needed for citrus, avocado, mango and other fruits on our rock soils. And as a diversified agriculture replaces the old single-crop of tomatoes on our glades, there will have to be much study of the adaptability of various strains of the truck crops which we substitute. And the possibility of a crop rotation being necessary will have to be investigated.

In a flat country whose natural forest cover has been removed long since and where the pernicious practice of periodic burning of the undergrowth is countenanced, there is great need of artificial protection from the winds. This need is already being recognized here, but we have little information as to the trees which will give protection most satisfactorily. It is our belief that the glade farms also will find the growing of windbreaks profitable, and an entirely different set of experiments will be necessary to ascertain the desirable varieties for planting there.

The vast number of fruits and vegetables which are adapted to our conditions only multiplies the tasks which confront our small staff. We shall not solve all the problems we now see in a decade or in two decades, and we will see new problems constantly. But we hope to have at least a large share in their solution, and to be as instrumental in advancing horticulture in this fruitful district as was visioned for us by those who were instrumental in procuring the establishment of this station.

DISEASES OF SUB-TROPICAL FRUITS

H. E. Stevens, Orlando, U. S. D. A.

Mr. Floyd asked me to lead the discussion on the disease side of the question this afternoon. However I am not going to do a great deal of talking, as I am limited to ten minutes by your chairman.

I will mention a few of the common troubles of the Avocado and some of the Mango. It was my pleasure some years ago to study the diseases of the Avocado, and I made that study in the Homestead section of your country here. Lack of soil used to be one of my great worries when I was working here. I wondered how a person could live in a place like this where you couldn't get soil enough to cover the roots of the trees. However, from what I have seen of the Avocados in this section, and in other sections of the State, and of your other fruit trees, such as the mango, there is no question but that this section of Florida is the Avocado section of the State for the varieties we have at present. It may be possible

that later we will develop varieties for Northern and Central Florida, but you have a monopoly on what are growing here at present.

Your Vice-President just mentioned the fact that when a crop becomes common why is it that so many of these pests and diseases follow. He probably has forgotten that these pests have to make a living themselves; and we quite often find when we bring trees or groups of plants together that they form a very convenient place for insects to breed and collect, and for plant diseases accumulate. That's why we have so many diseases. They begin accumulating as the possibility of the seed increases. They continue to increase as long as they have a favorable environment unless some force unknown or intervention by man prevents.

Now I will only touch on two of the Avocado diseases more common at this time—Scab and Fruit Spots.

The Scab of the Avocado is somewhat similar in its action to the Scab on citrus. It attacks the young, tender growth of the Avocado, also the fruit. It attacks the fruit in the very young stage, apparently from the time the bloom drops until six weeks or two months afterward. This scab is a fungus disease. The fungus causing the scab of the Avocado is very similar to the scab of citrus. I have taken the organism of Scab from Avocados and produced Scab on citrus. We have not been able to take the Scab from citrus and product it on the Avocado.

So our method of controlling Avocado Scab would be somewhat similar to the methods we employ on citrus,—absolute cleanup and spray with Bordeaux Mixture for one or two applications when the fruit is in a very young stage. When you do not care to make too many applications, as spraying is costly, probably two timely applications of Bordeaux Mixture 3-3-50 would help you control Scab. I notice it is the practice to make a dormant application before any bloom puts out. That is probably very well and all right, but in case you did not wish to make this extra spray I would rather delay it until the bloom has about dropped and fruit set—make one application then and follow with a second application a month later. I think those two applications would control Avocado Scab fairly well.

We do not apparently get into the trouble in the use of Bordeux Mixture on the Avocado that we do when it is used in a citrus grove, so if you are prepared to spray, and feel you can spend the money, three applications do better.

The other disease is Spotting of Fruit. There is one distinct spot known as the Black Spot. It derives its name from the peculiar black spot produced on the fruit, and this extends in a rotten mass down toward the seed. Quite often you can take them out and it will leave a depression in the fruit a half or more inches in depth. But there is another spot which I consider more serious, and that is Blotch. This is a small irregular blotch or pit on the surface of the fruit. They both occur about the same time, and I think a great deal of the Black Spot is secondary to the other type or Blotch. Blotch is caused by a fungus more or less parasitic. It is a species that has not been definitely determined yet. It winters over on leaves or on dead wood probably. The Black Spot, so far as I can judge from data I have obtained is a species of Collectotrichum similar to the Anthracnose that works on citrus fruit.

In regard to control, I carried out some spraying experiments over a period of two years. I had to leave that work before it was completed, and did not have an opportunity to make any further spraying experiments, but I found in the results of that two years work that two or three applications of Bordeaux mixture, I think that 4-4-50 was the formula, controlled these types of Spot perfectly.

Our first application, or the first application I will say that probably would be necessary to apply with the early maturing of seedling varieties would be an application the latter part of May, then another application in June, and possibly another in July. That should take care of the spotting under ordinary conditions of the early fruit, and the seedling fruit, fruit coming in from July until August.

With your late varieties you may have to extend the spraying period much longer, beginning later, and that is the problem that has to be worked out in the near future. We are planning to carry on some experiments here again this

season, and have outlined one or two for this section. I hope if we can continue in the work here so that we will be able to gather within a year or two some more data in regard to this disease, and ascertain the most economical method of control.

I have sketched a brief outline of the Avocado diseases, and will say a few words in regard to the Mango troubles. Those I have not studied very extensively. The greatest trouble we have with the Mangos is the fungus that effects the bloom, and is the cause of anthracnose. You have noticed it is difficult to set a crop of fruit of the Mangos on trees in this section if you have rainy periods, or warm weather during the rainy season.

There is a fungus related to the one we have in citrus groves that attacks the bloom and kills it out. It attacks very young fruit, makes scabby looking fruit, causes it to drop. In favorable conditions for the development of this fungus, the entire bloom may be blasted. Years ago, the Federal Government spent considerable investigating this trouble on the lower East Coast, but they didn't get very good results from spraying. I think they sprayed as often as two or three times a week, and under unusually rainy conditions it was apparently impossible to set the bloom.

I have seen Mango trees on this trip that seemed to be pretty well painted with Bordeaux Mixture. I don't know how much fruit they had, but the Bloom blight is a disease or trouble that needs more investigation, and one that I hope we can turn our attention to. If you have to spray two or three times a week through a period of several months I don't see how you can afford to produce Mangos.

I have had a little experience with copper lime dust but the results are hardly enough to recommend its use, but the results I have obtained from one or two season's trial has given me some encouragement in the use of this in the bloom. I believe it is going to be most difficult to try to carry through your early bloom of the Mango. That comes on in December or January. But I do believe that you can protect the late bloom that comes out, and set your crop of fruit either with the Copper Lime Dust or with the Bordeaux Spray.

THE PESTS OF SUB-TROPICAL FRUITS

J. R. Watson, Agricultural Experiment Station, Gainesville

As the previous speakers have said, the subject of Pests on any crop is not a popular one. Your typical promotor never mentions them, but any horticulturist knows we have pests. Even the Tung Oil tree is not exempt. So to be quiet on this subject, and to ignore the subject, only arouses the suspicion of the horticulturist.

Taking up, then, some of the insects of the Avocado, first I will say that on the whole, the problems you have in the Avocado insects are very similar to those you have with citrus. I am not saying the insects are the same, but they are comparable to them, and the control measures on the whole are very similar.

Taking the state as a whole, one of the worst pests of Avocado is the Pyriform Scale, which is flat and pear-shaped, and is entirely capable of taking the leaves off a tree quite promptly. It is apparently not as severe in this part of the State as it is to the North in the State. It is principally killed with the oil emulsions we use for citrus trees, but on the other hand, Avocado trees will not stand quite as heavy strength of oil sprays as citrus trees. The Avocado requires about three-fourths of one per cent of oil when the Avocado is fairly dormant, but one-half of one per cent when in active growth.

You probably are familiar with the fact that there are on the markets in Florida two types of oil emulsion; one, you will remember is made from red oils, the other from the white oils, so-called. The white oils are always safer from the standpoint of burning foliage, and if an Avocado is in active growth, you will be apt to get by with white oil emulsion without severe burning.

The Pyriform Scale has been called the White Fly of the Avocado, because it gives off honey-dew copiously which blackens up the tree; if the

tree turns black you can look for Pyriform Scale. Next in importance is the Dictyospermum Scale, which is comparable to the Purple Scale of citrus, and works in about the same way. It can be controlled in the same manner as Purple Scale namely with oil emulsions.

There is one of the Red Spiders that commonly attacks Avocados and sometimes does more or less damage. It is the same that attacks the camphor tree. You people from the Northern part of the State know occasionally your camphor tree turns rusty brown, but does not drop its leaves. This same red spider gets on the Avocado and does somewhat similar work as it does on the camphor trees. This is named after our friend Yothers, and called Yothersii. It is controlled by sulfur, in some form. You can spray with lime sulfur solution or dust with sulfur on the trees. Dusting with sulfur is much more simple, and easily applied. We recommend that ordinarily, but where the temperature is below seventy degrees, you will get better control of these spiders with the lime sulfur spray than by dusting with sulfur. But in a temperature in the eighties, dusting gives you good control and is easier applied, so the growers prefer it.

We have two species of thrips. The worst is the red banded thrip, common throughout the tropical regions of the world, however, it is found out-of-doors in Florida, only in this extreme southern part of the State. Sometimes it is a very serious pest on Avocados particularly, and on Mangos. It sucks the juice or sap from the leaves, and gives off an excretion which makes blotches on the leaf. They turn pale in color, and the presence of these blotches indicates the presence of thrips. These are controlled best by nicotine sulphate, which in commercial form is the standard Black Leaf Forty. We use about one part of it to 750 of water. Black Leaf Forty alone in water will not stick, but will roll off the insect, so we have to use some spreader or sticker. The standard spreader or sticker for these has been whale oil soap. But the experiments of Mr. Thompson, who is here, as well as other members of our department, show that of all of the common spreaders we have used, whale oil soap is about the poorest. Oil emulsion is a much better spreader than fish oil soap, and you can't use it on citrus trees. You can use it on your Mangos and your Avocados, so instead of the soap, which is recommended for a spreader for nicotine sulfate, you will substitute about one part of oil emulsion in 100 of water. With any of these emulsions you will get a better spreader than with the soap. There are still other spreaders on the market which are better. We don't care to advertise commercially, but you are all familiar with Penetrol and perhaps so with solium oleates such as Sofine. I mention this because with the newer spreaders you can reduce the amount of nicotine sulfate, and instead of one part to 750 all you will need is one part to 3,000 of water, which we use with these spreaders. For thrips use Penetrol a little more strong, not one one-half of one per cent but three quarts in 100 gallons of water will give you a better control.

Some insects attack the blossoms of the Avocado, but our time is up.

Mr. C. I. Brooks: Are there any special insects that attack the Mango?

Member: There is a little bug that belongs to the June Bug Tribe that does sometimes. It is not a pest you have every year.

Mr. Brooks: Is there anything to do for it?

Member: Yes, you can use arsenic compounds.

Member: What is the best time to spray for fungus, before or during or after the bloom?

Mr. Stevens: That's a pretty hard question to answer. I have but very little hope for bloom that comes in December, to carry through. If I were going to spray the late bloom, in April or May, I would give one application about the time those bloom buds came out. Then I would wait until a little fruit had set, and give another application, and probably following that I would give a third application, two or three weeks later. If they didn't get through with that, I would let them go.

REPORTS

Report of Committee on Necrology

(Moved and seconded that the report be accepted and filed. Unanimously carried.)
(See insert following this page.)

Honorary Membership

H. Harold Hume, Jacksonville: The welfare and activities of this Society have been largely influenced by the men who started it, and the men who have headed its activities over a number of years. This older group of men is becoming increasingly scarce. I think it is our general tendency to pay tribute to them after they are gone, but I am one of those who believe in telling a man something about what we think of him, or by our actions, designate as much, before he leaves us.

One of the men who has had more to do with the building of this Society and the keeping up of it on a straight and even keel over a long period of years is with us this morning. I say with full knowledge of what I am saying that he has had more to do over a longer period of time with the building of this Society and the direction of its plans than anyone else in our midst—and this has gone on in some measure noticed by you, the members, and in some measure, again, in many ways not known to you at all—and for that reason I wish this morning to nominate and move the adoption of the nomination by the Society for an honorary membership to it of Mr. L. B. Skinner.

(This nomination was seconded by Frank Stirling, and a rising vote taken. The motion was carried unanimously).

L. B. Skinner: I can't let the action of the Society go without just a word. I am overcome. I feel sure the Society has done a lot more for me than I have done for it,—far more. I hope in the years to come—(I hope with the aid of orange juice and other things I will live for a great many years)—that I will be able,—at least, I shall try—to do as much as I can, and all that lies within my power for the Society.

Committee for 1931 Meeting

AUDITING COMMITTEE

C. W. Lyons, H. J. Edsall, H. W. Dorn.

NOMINATING COMMITTEE

L. B. Skinner, H. G. Clayton, S. F. Williams.

FINAL RESOLUTIONS

J. R. Winston, Marvin Walker, Albert DeVane.

LEGISLATIVE COMMITTEE

Frank Stirling, Chairman,
J. C. Chase,
N. A. Reasoner,
B. D. Barber,
C. I. Brooks,
C. W. Lyons,
W. J. Ellsworth,
R. P. Burton,
M. J. Daltwyler,
J. A. Griffin.

Deceased Members

George L. Taber

Frederick D. Waite

E. H. Mote

Paul Wagner

George Lindley Taber

Glen St. Mary, Florida

1854 - 1929

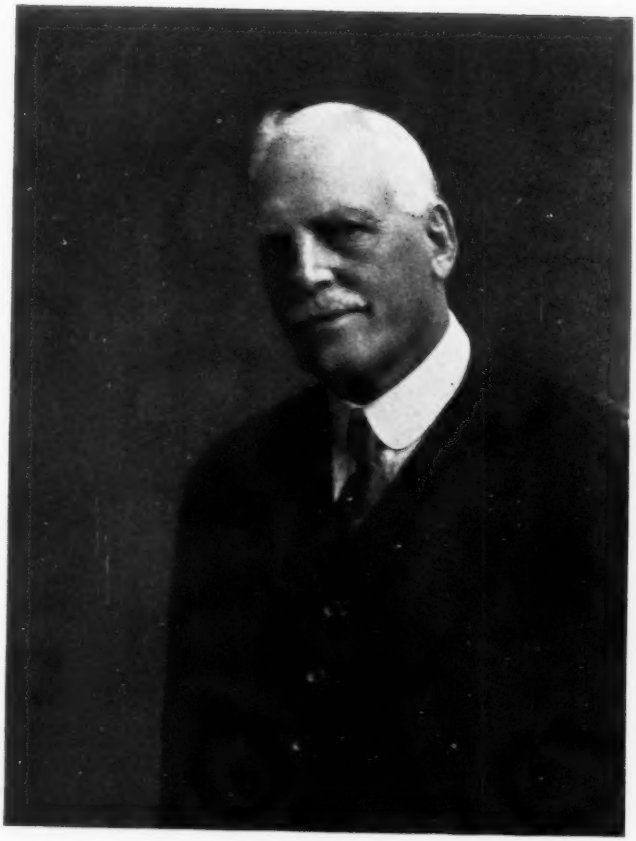
Charter Member.
Honorary Member 1914.
Life Member 1893.
Secretary 1888-1891.
Vice-President 1892-1897.
President 1898-1904.
Executive Committee 1905-1916.

Born Vassalboro, Maine, Oct. 18, 1854.
Died Jacksonville, Fla., May 10, 1929.
Educated at Oakgrove Seminary, Vassalboro, Maine, and at Moses Brown Friends School, Providence, R. I.

Employee Chicago Board of Trade to 1881.
Organized Glen St. Mary Nurseries Co., 1882.
Originated and Introduced Excelsior Plum.
Introduced Jewel, Waldo and Angel Peaches: and Duncan Grapefruit.

Brought Satsuma Orange and Kumquat to prominence in Southern Gulf States.

Prominent leader in State.



GEORGE LINDLEY TABER
GLEN ST. MARY, FLORIDA
1854-1929

Frederick D. Waite

Palmetto, Florida

1858 - 1931

Life Member 1906

Annual Member 1897.

Vice-President 1907.

Nurseryman at Belleview to 1899.

Manager Manatee Fruit Company for many years.

Owner and operator of large citrus grove interests.

Prominent leader in community and State.

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Annual Report of Secretary
April 14, 1931

BALANCE SHEET

ASSETS

Cash in Bank	$	62.94
Treasurer		351.06
		414.00

LIABILITIES

B. F. Floyd	$	414.00

STATEMENT OF OPERATIONS

Annual Memberships	$	512.00
Sale of Proceedings		53.50
Sale of Advertising (1929)		125.00
Life Membership		25.00
Patron Membership		100.00
	$	815.50
Less Expenses	$	452.52
Net gain	$	362.98

CASH RECEIPTS

Balance 4-8-30	$	174.96
Receipts (See Operating Statement)		815.50
	$	990.46

DISBURSEMENTS

Expenses (Operating Statement)	$	452.52
Remittance to Treasurer		475.00
	$	927.52
Balance on hand		62.94
	$	990.46

Annual Report of Treasurer
April 14, 1931

CHECKING ACCOUNT

Balance forward	$	196.04

RECEIPTS

1 Patron at	$ 100.00		
From Secretary for 1930 memberships—			
1 Life at	25.00		
175 Annual at $2.00	350.00	$	475.00
1930 Memberships Treasurer's office			
235 Annual at $2.00	$ 470.00	$	470.00
Contributions		$	16.00
Sale of two Proceedings, 1929		$	4.00
Reserved for 6 Proceedings, 1931 combination offer			9.00
Interest			82.63
Advertising, 1930 Proceedings			880.00
Borrowed from Savings			300.00
			$2,432.67

EXPENDITURES

E. O. Painter, bal. 1929 Pro.	$ 685.19	
E. O. Painter, 1930 Pro.	1,135.45	
Treasurer's Bond	12.50	
Brice Printing Company	26.18	
Prompt Printery	10.25	
To Sec'y. Floyd, balance 1929 Memberships	30.00	
Office Expense and Stamps	66.80	
Exchange on foreign check	.27	
Transferred to Savings for 1 patron and 1 life mem., 1930	125.00	
Transferred to Savings for balance 1929. Perennial memberships collected, $54.00; less due from Savings for 1930 Perennial memb., $44.00	10.00	
	$2,101.64	
Balance at bank	331.03	
	$2,432.67	$2,432.67

RECONCILIATION

Apparent Balance		$ 331.03
Due from Savings for interest in 1930		5.69
Due from Savings for 1931 dues 10 Perennial Memberships		20.00
1930 Advertising checks on hand for deposit		70.00
		$ 426.72
Due Endowment funds	$1,300.00	
Operating deficit		873.28
	$1,300.00	$1,300.00
Operating deficit last year		$ 843.96
Increase in deficit		$ 29.32
1929 printing bill paid in 1930 (not shown as liability in last report)		685.19
Actual gain, therefore		$ 655.87

STATEMENT OF ENDOWMENT ACCOUNT

SAVINGS ACCOUNT

Balance forward, April 1st, 1930		$ 188.00
Received for Perennial memberships collected in 1929, $54.00, less $44.00 due current funds for 1930, dues for 22 Perennial memberships		10.00
Received for 1930 (1 Patron and 1 Life membership),		125.00
		$ 323.00
Loaned to current funds		300.00
Balance April 1st, 1931		$ 23.00
Due current funds for 1931 dues for ten Perennial members		$ 20.00
Net Balance		$ 3.00
Due from current funds		$1,300.00
Bonds on deposit with bank		3,150.00
Total Endowment		$4,453.00

Report of Auditing Committee

We, the undersigned of your auditing committee beg leave to report that we have examined the books and vouchers of the Secretary and Treasurer and find them correct.*

C. W. LYONS,
H. W. DORN.

Report of Executive Committee

MEETING APRIL 9, 1930, SEBRING, FLORIDA

The only business transacted was to authorize the Secretary to publish one hundred copies of the Proceedings in excess of the actual membership at time of going to press.

MEETING JANUARY 28, 1931, HAVEN HOTEL, WINTER HAVEN

This was the regular Spring meeting of the committee. The finances of the Society were discussed. Plans were made for holding the Forty-fourth Annual Meeting of the Society in Miami. Date for holding meeting was set at April 14th to 17th inclusive, 1931. The Columbus Hotel, Miami, was selected as headquarters and meeting place for the Society. The Secretary was instructed to complete plans for the meeting.

MEETING APRIL 24, 1931, AT HILLSBORO HOTEL, TAMPA, FLORIDA

This was a combined meeting of the Executive Committee with the Legislative Committee. Matters of legislative importance were discussed and action decided upon. A committee was appointed to consider the advisability of forming and financing a Florida Agricultural Legislative Committee along the same lines of a similar committee in California. The members appointed by President Taylor were Marvin Walker, Chairman; C. W. Lyons, R. B. Woolfolk, J. A. Griffin and C. I. Brooks.

*Treasurer's books were audited at a later time.

Report of Legislative Committee

Frank Stirling, Chairman

The Legislative committee designed by your body to carry out the functions imposed, and intended to be carried out, have considered very carefully the responsibilities imposed upon the shoulders of this committee by you, and this committee has spent a good deal of time during the past several weeks looking into the things it thought would be of benefit to the Horticulture and Agriculture of this State, and to the things that you would be interested in.

Among some other things considered, perhaps the most outstanding, and perhaps the most needful was this: This committee has had called to its attention rather authentic reports that efforts would be made or had been made by members of our Legislature in the carrying out of their policy of economy to curtail certain activities of some of the State institutions, especially your agricultural schools, and particularly with reference to your College of Agriculture, your Agricultural Experiment Station and your State Plant Board. This committee, about two weeks ago made a very careful investigation of the activities of these schools that I have mentioned, not only of the things that they have been doing for you in the past, but of the needs and requirements that will come in the future, and they have found this, that especially with reference to the College of Agriculture and Experiment Station, the Board of Control in making estimates for appropriations to be asked for, the totals are less than the totals that are in vogue for the present biennial. With that in mind, this committee has prepared a set of resolutions which I am going to present to you for your approval:

RESOLUTIONS

Whereas, the sole reason for the existence of the Horticultural Society is the fostering, development and protection of the agriculture of Florida, and

Whereas, from various sources and through various channels information has reached us that efforts are being, or will be made, to curtail appropriations for the use of the Agricultural College, Experiment Station and State Plant Board, thereby jeopardizing and placing in hazard the efficiency of the very organizations and institutions which have through the years past contributed in great measure to the development and protection of our agricultural industry, and

Whereas, in our judgment the necessity is as great today or greater under existing economic conditions than in the past, even for a continuance of the magnificent work accomplished by these organizations,

Now Therefore Be It Resolved by the State Horticultural Society in annual session at Miami, this 16th day of April, 1931,

1. That we regard with fear and apprehension any effort that may be made to accomplish the end recited in this preamble, to-wit, impairment of efficiency.

2. That we express our appreciation here and now for the assistance which has heretofore been rendered to us through the Agricultural College, Experiment Station and the State Plant Board.

3. That we urge upon the Legislature now in session the provision of ample funds for the carrying forward and the expansion of the educational research and protection as directed by the State Board of Control and the State Plant Board.

4. That the Secretary of this Society is instructed to transmit copies of this resolution to his Excellency, Governor Carlton, to the Speaker of the House of Representatives and the President of the Senate.

(Resolutions presented by Legislative Committee. The adoption of same moved by Frank Stirling, seconded by Mr. Woolfolk. Unanimously carried).

Report of Meeting Place Committee

S. F. Poole: A committee was appointed yesterday to bring in a report in regard to the method of selecting the next place for this meeting. Major Floyd is chairman of this committee. We will have his report at this time.

Major Floyd: The committee appointed for the purpose of looking into the possibility of adapting a different method of selecting the meeting place for the annual meeting, respectfully recommends as follows:

"That the State be divided into four horticultural sections, southeastern, central, southwestern and northern, and that meetings be held in rotation in the different sections.

Respectfully submitted,
W. L. FLOYD,
J. B. EATON,
L. B. SKINNER,
Committee."

S. F. Poole: The Chair fails to see where this committee has followed the instructions. This committee was instructed to report on a method of choosing a place for the annual meeting, and in view of the fact that the report does not cover this matter, we will let the method of selecting a place remain in status quo.

Report of Committee on Resolutions

The following committee was appointed to draft the proper resolutions to be sent, one to President John S. Taylor, and the other to Vice-President C. I. Brooks, who are lil. The committee consists of: S. F. Williams, G. H. Blackmon, L. B. Skinner.

S. F. Williams: The Committee begs to report that it has located Mr. C. I. Brooks, the Vice-President, and sent a wire to President Taylor at Largo, assuring him the meeting is going on fine, and hoping for his recovery, etc.

Final Resolutions

Whereas, the members of the Florida State Horticultural Society, in 44th annual meeting at Miami, have enjoyed a most interesting program of instructive discusions and pleasant entertainments, and

Whereas, the Society desires to express its appreciation to those responsible for this exceptionally successful gathering, and in particular

To Mr. J. S. Rainey, Agricultural Agent of Dade County, who handled arrangements and who constantly attended the Society's activities;

To C. H. Steffani, Agricultural Agent of South Dade County who arranged for the visit to the Homestead section;

To Mary Drake and Gerry Curtis, and their assistants, who staged the Sixth Annual State Rose Show, which was a part of our program;

To Dr. and Mrs. David Fairchild, for a very pleasant Garden Party, and to Mrs. Arthur Curtis James, for permission to view the plantings on her estate;

To Mr. C. H. Crandon, Chairman of the Board of County Commissioners, for the arrangements which permitted our members to see the Matheson Hammock Park;

To Mr. Wm. M. Gale, Manager of the Columbus Hotel, for his courteous attention to the wants of our members and for the excellent facilities which he provided for our meeting;

To the Miami Rotary Club for the amplifiers used during our meeting, and to

Mr. E. A. Robinson of the Robinson Electric Company, for servicing them;

To The Agricultural Department of Dade County, for the aerial views of the city from Curtis-Wright planes, which they arranged for our members;

To Miss Marie Easton, for her valuable assistance in the registering of members;

To the Citizens of Miami for their many courtesies, including the furnishing of cars for our transportation;

To The Rotary Clubs of Homestead and Miami and to the Lions Club of Miami, for their invitations to have our members address their meetings;

To Mr. C. Clinton Page and Mr. R. G. Rinc, Agricultural editors of the Miami Daily Herald and the Miami Daily News, respectively, for their capable reports of our meetings; and

To the newspapers and magazines of Florida for the liberal space which they gave our advance notices of this meeting;

Therefore Be It Resolved by the Florida State Horticultural Society in annual meeting at Miami, the 16th day of April, 1930, that we express our appreciation to these many persons and agencies for the facilities provided, and for the courtesies they extended in making our meeting so successful and pleasant.

Moved and Seconded this Report be adopted. Unanimously carried.

Report of Nominating Comittee

The Nominating Committee desires to make the following report and to place in nomination the following named men for officers of this Society as shown:

President, John S. Taylor, Largo.
Vice-President, S. F. Poole, Lake Alfred.
Vice-President, C. W. Lyons, Tampa.
Vice-President, C. I. Brooks, Miami.
Secretary, Bayard F. Floyd, Davenport.
Treasurer, N. A. Reasoner, Oneco.
Executive Committee: Frank Stirling, Davie; W. L. Drew, Eagle Lake; H. Harold Hume, Gainesville.

There being no nominations from the floor, a vote was taken that resulted in the unanimous election of the above named officers.

Selection of Meeting Place for 1932

Invitations were extended from Jacksonville and Gainesville. Gainesville was unanimously selected as the meeting place for the 1932 meeting.

TABLE I

LULA AVOCADO ANALYSES — LAKE PLACID, FLORIDA — 1930-31

Fruit No.	No. Fruit	Date Picked	Date Tested	Condition of Fruit	Total Weight (Gms.)	% Seed	% Skin	% Pulp	% Ash	% Moisture	Specific Gravity	% Oil & Fat: Green Basis	% Oil & Fat: Dry Basis
1A	22	5-3-30	5-6-30	Hard	148.2	11.72	25.89	62.39	-	86.17	1.0287	0.89	6.44
*1B	20	5-3-30											
2A	6	5-24-30	5-27-30	Hard	154.0	14.05	24.11	61.84	0.08	87.10	1.0314	1.05	8.18
*2B	6	5-24-30											
3A	5	6-14-30	6-17-30	Hard	452.5	17.91	18.75	63.34	0.31	87.53	1.0013	1.04	8.34
*3B	5	6-14-30											
4A	2	7-5-30	7-7-30	Hard	383.1	20.28	14.50	65.22	0.76	86.64	1.0298	1.01	7.69
*4B	2	7-5-30											
5A	2	7-26-30	7-28-30	Hard	364.5	21.70	16.34	61.96	0.50	85.09	1.0047	1.41	8.93
*5B	2	7-26-30											
6A	1	8-16-30	8-23-30	Hard	389.7	26.49	12.00	61.52	0.51	84.81	0.9791	5.47	36.03
6B	1	8-16-30	10-11-30	Soft	384.5	28.91	10.27	60.82	0.71	84.85	0.9413	6.16	40.66
7A	1	9-6-30	9-11-30	Hard	400.5	25.42	13.34	61.24	0.22	82.25	0.9828	3.74	21.07
7B	1	9-6-30	10-3-30	Soft	435.0	-	-	-	0.47	80.34	0.8992	9.77	49.71
8A	1	9-27-30	10-1-30	Hard	531.5	30.77	13.67	55.56	0.55	79.82	0.9826	9.18	45.50
8B	1	9-27-30	12-13-30	Soft	522.4	13.97	09.98	56.05	1.00	74.31	0.8304	13.64	53.08
9A	1	10-18-30	10-22-30	Hard	489.0	30.10	13.61	56.29	1.58	79.85	0.9649	10.55	51.83
#9B	1	10-18-30											
10A	1	11-8-30	11-11-30	Hard	450.0	35.11	11.34	53.55	0.90	75.97	0.9931	13.68	56.95
10B	1	11-8-30	12-19-30	Soft	508.7	30.54	10.44	59.02	0.70	67.66	0.9326	14.35	44.38
11A	1	11-29-30	12-4-30	Hard	717.7	32.02	10.60	57.38	0.72	80.46	0.9676	11.12	56.90
11B	1	11-29-30	12-20-30	Soft	588.5	26.92	08.79	64.29	0.67	75.42	0.9752	8.23	33.51
12A	1	12-10-30	12-12-30	Hard	724.5	25.30	11.38	63.32	1.09	71.41	0.9716	17.81	62.31
12B	1	12-10-30	1-26-31	Soft	636.0	15.08	07.23	57.69	0.78	73.80	0.9407	16.18	61.74
13A	1	1-10-31	1-12-31	Hard	494.0	20.10	10.36	69.54	0.75	75.55	0.9709	12.90	52.76
13B	1	1-10-31	2-6-31	Soft	499.7	28.92	09.08	62.00	0.96	69.32	0.9328	17.85	57.64
14A	1	1-31-31	2-2-31	Hard	399.5	15.69	12.53	71.78	0.63	73.15	0.9184	14.41	53.70
14B	1	1-31-31	2-28-31	Soft	446.6	28.25	09.00	62.75	0.79	68.30	0.9528	20.61	64.94
15A	1	2-22-31	2-27-31	Hard	445.4	13.54	10.32	76.14	1.17	70.33	0.9184	16.08	54.18
15B	1	2-22-31	3-16-31	Soft	424.4	20.20	10.40	62.06	0.85	71.40	0.9532	17.80	62.30

* Never Ripened.
\# Spoiled.

TABLE II

LULA AVOCADO ANALYSES

Homestead, Florida -- 1930-31

Fruit No.	No. Fruit	Date Picked	Date Tested	Days to Soften	Condition of Fruit	Total Weight (Gms.)	% Seed	% Skin	% Pulp	Specific Gravity	% Moisture	% Oil & Fat: Green Basis	% Oil & Fat: Dry Basis
1A	8	4-29-30	5-2-30		Hard	051.12	11.21	20.74	68.05	1.0407	80.34	0.70	3.56
*1B		4-29-30											
2A	12	5-31-30	6-2-30		Hard	227.92	08.54	29.21	62.25	1.0228	87.92	0.57	4.72
*2B		5-31-30											
3A	4	7-1-30	7-3-30		Hard	370.00	22.86	21.48	55.66	1.0054	88.20	1.25	10.54
*3B		7-1-30											
4A	1	8-2-30	8-5-30		Hard	197.50	16.61	19.44	63.95	1.0400	85.30	1.20	8.10
*4B		8-2-30											
5A	1	8-30-30	9-2-30		Hard	350.40	20.59	12.93	66.48	0.9839	83.33	6.68	40.09
5B	1	8-30-30	12-13-30	104	Soft	220.59	14.01	16.54	49.35	0.7194	77.16	11.41	49.96
6A	1	10-1-30	10-4-30		Hard	498.60	25.03	12.98	61.99	0.9646	80.61	08.86	45.67
#6B		10-1-30											
7A	1	11-1-30	11-3-30		Hard	524.8	19.91	14.15	65.94	0.8978	77.61	09.96	44.89
7B	1	11-1-30	1-2-31	61	Soft	285.2	12.09	09.52	58.39	0.8166	73.90	14.42	55.21
8A	1	11-29-30	12-3-30		Hard	526.0	17.73	13.06	69.21	0.9053	75.85	08.16	33.78
8B	1	11-29-30	1-10-31	41	Soft	504.0	24.25	08.33	67.42	0.9692	73.04	09.89	36.68
9A	1	1-1-31	1-3-31		Hard	583.2	19.78	12.62	67.60	0.9170	71.00	09.30	32.08
9B	1	1-1-31	2-6-31	36	Soft	512.9	25.24	08.41	66.35	0.9159	71.26	16.82	58.52
10A	1	1-31-31	2-3-31		Hard	574.2	30.56	10.76	58.68	0.9261	76.69	13.93	59.77
10B	1	1-31-31	2-28-31	28	Soft	592.0	30.98	08.21	60.81	0.9250	68.98	14.85	61.71

* Never Ripened.
\# Analysis Lost.

(See text pages 81-86)

TABLE III

TAYLOR AVOCADO ANALYSES - LAKE PLACID, FLORIDA — 1930-31

Fruit No.	No. Fruit	Date Picked	Date Tested	Condition of Fruit	Total Weight (Gms.)	% Seed	% Skin	% Pulp	% Ash	% Moisture	Specific Gravity	% Oil & Fat Green Basis	% Oil & Fat Dry Basis	% Total Sugar	% Protein
1A	37	5-3-30	5-6-30	Hard	187.1	12.2	22.9	64.9	0.11	86.53	1.0278	1.67	12.40	1.76	1.25
*1B	35	5-3-30													
2	33	5-24-30	5-26-30	Hard	180.1	13.45	27.65	58.90	0.12	85.83	1.0330	0.70	04.93	2.04	1.42
*2B	44	5-24-30													
3	5	6-14-30	6-16-30	Hard	312.3	17.64	30.67	51.69	0.31	87.34	1.0140	1.26	10.03	2.46	1.40
*3B	5	6-14-30													
4	3	7-7-30	7-7-30	Hard	392.3	15.72	23.51	60.77	0.34	87.28	1.0005	0.85	06.67	2.02	1.48
*4B	1	7-7-30													
5A	3	7-26-30	8-1-30	Hard	345.8	20.30	21.70	58.00	0.54	83.42	1.0014	1.55	09.36	1.98	1.52
5B	1	7-26-30	8-27-30	Soft	332.5	18.34	21.17	60.49	0.54	81.45	0.8184	1.75	09.36	1.08	2.08
6A	1	8-16-30	8-20-30	Hard	240.4	19.80	19.16	61.04	0.31	83.86	0.9909	4.66	28.88	1.02	1.66
6B	1	8-16-30	10-29-30	Soft	218.3	27.95	25.17	46.88	0.61	76.07	0.6911	5.90	17.13	0.97	1.98
7A	1	9-6-30	9-9-30	Hard	378.4	17.82	22.69	59.49	0.36	83.74	0.9919	11.27	69.32	1.42	1.78
7B	1	9-6-30	12-21-30	Soft	371.7	26.14	24.91	48.91	0.40	75.01	0.7044	9.19	36.84	1.56	1.81
8A	1	9-27-30	9-29-30	Hard	263.4	26.56	15.72	57.72	0.59	78.38	0.9810	10.33	47.80	1.08	1.83
8B	1	9-27-30	12-13-30	Soft	269.4	29.74	17.78	52.48	0.71	72.31	0.7442	15.69	55.19	1.08	1.94
9A	1	10-18-30	10-20-30	Hard	228.5	20.59	22.66	56.75	0.59	81.54	0.9909	7.99	43.24	0.75	1.80
9B	1	10-18-30	12-2-30	Soft	187.4	12.99	19.19	67.82	0.35	73.50	0.7807	9.65	36.28	0.64	2.10
10A	1	11-8-30	11-11-30	Hard	277.7	23.16	14.06	62.78	0.76	79.90	0.9626	10.79	52.67	0.97	1.88
10B	1	11-8-30	12-22-30	Soft	207.5	28.94	18.31	52.75	0.61	77.31	0.8465	9.10	40.17	0.87	2.05
11A	1	11-29-30	12-1-30	Hard	261.3	24.10	19.53	56.37	0.75	79.14	0.9772	11.77	56.20	0.84	1.90
11B	1	11-29-30	1-10-31	Soft	197.3	25.69	19.20	55.11	0.87	77.30	0.8311	11.49	51.19	0.96	1.95
12A	1	12-10-30	12-13-30	Hard	279.5	15.15	18.58	66.27	0.74	77.58	0.9658	13.27	59.21	0.81	1.83
12B	1	12-10-30	1-26-31	Soft	296.0	25.16	11.98	62.86	0.80	75.61	0.8579	13.33	54.61	0.80	1.86
13A	1	1-10-31	1-12-31	Hard	370.6	26.78	13.51	59.71	0.61	75.61	0.9733	16.98	69.64	0.84	1.52
13B	1	1-10-31	1-22-31	Soft	307.2	21.32	14.75	63.93	0.65	74.98	0.9165	16.63	66.20	0.85	1.81
14A	1	1-31-31	2-2-31	Hard	283.0	21.70	18.16	60.14	0.70	75.22	0.9759	16.47	66.45	0.72	1.98
14B	1	1-31-31	1-2-31	Soft	346.7	20.58	22.64	56.78	0.89	73.10	0.9248	16.50	65.08	0.94	2.01
15A	1	2-22-31	2-25-31	Hard	296.3	24.50	26.00	49.50	0.90	72.42	0.9943	19.59	71.00	0.85	0.98
15B	1	2-22-31	3-20-31	Soft	249.5	21.30	14.70	64.00	0.89	72.31	0.8798	15.68	55.20	0.90	1.16

* Never Ripened.

TABLE IV

TAYLOR AVOCADO ANALYSES HOMESTEAD, FLORIDA -- 1930-31

Fruit No.	No. Fruit	Date Picked	Date Tested	Condition of Fruit	Total Weight (Gms.)	% Seed	% Skin	% Pulp	% Ash	% Moisture	Specific Gravity	% Oil & Fat Green Basis	% Oil & Fat Dry Basis	% Total Sugar	% Protein
1A	260	4-26-30	4-30-30	Hard	96.20	#	#	#	0.56	84.34	1.0289	0.48	03.24	2.40	0.98
*1B	200	4-26-30													
2A	14	5-17-30	5-20-30	Hard	111.85	12.92	28.30	58.78	0.48	84.82	1.0301	1.43	09.44	2.70	1.24
*2B	14	5-17-30													
3A	6	6-7-30	6-9-30	Hard	130.70	14.69	44.76	40.50	0.10	87.66	1.0171	1.83	14.80	2.10	0.53
*3B	6	6-7-30													
4A	4	6-28-30	6-30-30	Hard	283.60	18.61	20.73	60.66	0.45	88.37	1.0035	1.39	12.40	1.78	0.72
*4B	4	6-28-30													
5A	2	7-19-30	7-22-30	Hard	204.9	19.66	18.14	62.20	--	87.36	1.0110	0.80	04.49	1.94	0.91
*5B	2	7-19-30													
6A	2	8-9-30	8-11-30	Hard	328.5	20.98	16.54	62.48	0.58	84.74	1.0021	0.91	11.04	1.76	0.65
*6B	2	8-9-30													
7A	2	8-31-30	9-1-30	Hard	366.9	21.42	16.63	61.95	0.51	85.22	0.9968	3.77	25.97	1.84	0.97
7B	2	8-31-30	10-30-30	Soft	412.4	30.07	12.19	57.74	--	82.21	0.9328	6.10	34.27	1.65	1.34
8A	1	9-20-30	9-27-30	Hard	324.6	21.42	14.57	64.01	0.86	65.62	0.9759	14.50	41.85	1.80	1.24
8B	1	9-20-30	12-1-30	Soft	290.2	30.57	15.91	53.52	0.82	76.18	0.7423	9.02	41.35	1.20	1.26
9A	1	10-11-30	10-13-30	Hard	314.4	18.16	15.33	66.51	0.64	80.28	0.9716	8.67	44.14	1.32	1.08
9B	1	10-11-30	12-20-30	Soft	311.5	25.61	11.41	61.98	0.96	76.43	0.8256	12.68	54.08	0.94	1.87
10A	1	11-1-30	11-4-30	Hard	439.2	17.64	09.58	72.78	0.75	83.83	0.9325	9.84	61.17	1.10	1.21
10B	1	11-1-30	1-2-31	Soft	375.7	19.28	08.43	72.29	1.00	81.41	0.7674	11.52	55.70	0.84	1.50
11A	1	11-22-30	11-26-30	Hard	375.2	15.62	11.06	73.32	1.22	78.71	0.9422	13.12	61.65	1.25	1.25
11B	1	11-22-30	1-9-31	Soft	347.1	19.50	07.73	72.87	1.24	74.04	0.8747	14.20	55.45	0.95	1.12
12A	1	12-15-30	12-18-30	Hard	360.0	15.50	12.46	72.04	1.08	74.51	0.9549	16.13	63.24	1.02	1.02
12B	1	12-15-30	1-14-31	Soft	365.9	15.52	07.76	76.72	0.92	75.84	0.8778	16.17	66.92	0.96	1.01
13A	1	1-3-31	1-6-31	Hard	391.3	16.69	09.08	74.23	1.07	75.14	0.9317	15.11	62.14	0.94	1.02
13B	1	1-3-31	2-6-31	Soft	361.5	23.49	08.22	68.29	1.01	69.62	0.8334	20.20	66.51	0.71	1.34
14A	1	1-24-31	1-29-31	Hard	407.8	21.09	11.75	67.16	1.02	73.68	0.9268	16.37	62.22	1.18	1.40
14B	1	1-24-31	2-28-31	Soft	339.8	18.59	07.94	73.47	1.04	72.33	0.9188	20.02	72.29	0.69	1.08
15A	1	2-16-31	2-18-31	Hard	331.0	18.19	13.81	68.00	1.27	74.39	0.9438	17.12	66.83	1.32	1.11
15B	1	2-16-31	4-4-31	Soft	317.5	19.53	08.32	72.15	1.21	73.66	0.9018	16.35	62.20	1.25	1.49

* Never Ripened.
# Too small to differentiate.

(See text pages 81-86)

TABLE V

COLLINSON AVOCADO ANALYSES

Homestead, Florida -- 1930 - 31

Fruit No.	No. Fruit	Date Picked	Date Tested	Days To Soften	Condition of Fruit	Total Weight (Gms.)	% Seed	% Skin	% Pulp	Specific Gravity	% Moisture	% Fat & Oil	
												Green Basis	Dry Basis
1A	12	5-31-30	6-2-30		Hard	135.5	13.68	33.06	53.26	1.0182	87.74	0.80	6.61
*1B	12	5-31-30											
2A	4	7-1-30	7-4-30		Hard	259.0	15.53	23.86	60.45	1.0080	87.73	2.06	16.13
*2B	4	7-1-30											
3A	1	8-2-30	8-6-30		Hard	260.8	17.97	17.20	64.82	1.0065	87.00	1.87	14.41
*3B	1	8-2-30											
5A	1	8-30-30	9-2-30		Hard	404.1	19.28	13.41	67.30	0.9963	87.27	3.95	31.03
5B	1	8-30-30	12-16-30	107	Soft	393.8	29.42	17.22	53.35	0.9746	81.99	7.72	42.94
6A	1	10-1-30	10-5-30		Hard	485.6	12.19	14.13	73.68	0.9303	81.84	9.47	52.11
6B	1	10-1-30	1-8-31	100	Soft	511.9	19.64	16.20	64.16	0.7481	77.26	10.35	45.54
7A	1	11-1-30	11-5-30		Hard	563.4	15.73	12.28	72.00	0.9581	82.77	09.48	55.00
7B	1	11-1-30	12-30-30	60	Soft	574.9	24.26	11.87	63.88	0.8014	76.48	14.89	63.31
8A	1	11-29-30	12-3-30		Hard	705.0	15.81	12.86	71.33	0.9216	76.55	15.01	64.12
8B	1	11-29-30	1-16-31	48	Soft	701.0	13.03	09.56	77.39	0.8276	73.89	18.03	66.22
9A	1	1-1-31	1-3-31		Hard	809.9	15.52	11.26	73.22	0.9331	74.08	14.92	56.49
9B	1	1-1-31	2-6-31	37	Soft	821.6	17.03	07.95	75.02	0.8849	72.90	16.71	61.64

* Never Ripened.

TABLE VI

WALDIN AVOCADO ANALYSES

Homestead, Florida -- 1930-31

Fruit No.	No. Fruit	Date Picked	Date Tested	Days to Soften	Condition of Fruit	Total Weight (gms.)	% Seed	% Skin	% Pulp	Specific Gravity	% Moisture	% Oil & Fat	
												Green Basis	Dry Basis
1A	10	4-29-30	5-2-30		Hard	37.73	12.29	18.87	68.84	1.0217	84.39	1.75	8.05
*1B	10	4-29-30											
2A	6	5-31-30	6-2-30		Hard	186.3	13.20	19.27	67.53	1.0253	83.49	1.37	8.30
*2B	6	5-31-30											
3A	4	7-1-30	7-4-30		Hard	297.4	21.04	16.36	62.60	1.0001	86.36	2.42	17.79
*3B	4	7-1-30											
4A	1	8-2-30	8-6-30		Hard	209.8	13.23	26.16	60.61	0.9964	86.14	2.43	17.54
*4B	1	8-2-30											
5A	1	8-30-30	9-3-30		Hard	376.2	27.21	11.45	61.34	0.9955	84.00	5.17	32.31
5B	1	8-30-30	11-30-30	92	Soft	198.9	22.40	10.44	66.76	0.9755	84.22	6.91	43.81
6A	1	10-1-30	10-6-30		Hard	412.4	30.08	12.18	57.74	0.9928	82.22	6.10	34.27
6B	1	10-1-30	12-22-30	82	Soft	426.7	21.12	11.19	75.69	0.8901	81.65	8.35	45.50
7A	1	11-1-30	11-3-30		Hard	530.1	24.63	09.66	65.51	0.9793	81.27	8.62	46.05
7B	1	11-1-30	1-3-31	64	Soft	542.1	11.96	08.52	59.52	0.9608	77.57	8.76	39.01
8A	1	11-29-30	12-6-30		Hard	554.0	16.61	12.08	71.31	0.9739	77.41	10.54	46.68
8B	1	11-29-30	12-16-30	16	Soft	585.0	27.97	09.78	62.25	0.9219	77.10	14.95	65.29

* Never Ripened.

(See text pages 81-86)

TABLE VII

POLLOCK AVOCADO ANALYSES

Homestead, Florida -- 1930-31

Fruit No.	No. Fruit	Date Picked	Date Tested	Days to Soften	Condition of Fruit	Total Weight (Grms.)	% Seed	% Skin	% Pulp	Specific Gravity	% Moisture	% Oil & Fat	
												Green Basis	Dry Basis
1A	8	4-29-30	5-2-30		Hard	40.62	13.98	17.82	68.20	1.0545	85.15	1.22	7.94
*1B	8	4-29-30											
2A	12	5-31-30	6-2-30		Hard	300.35	17.13	25.98	56.89	1.0182	83.97	1.50	11.15
*2B	12	5-31-30											
3A	4	7-1-30	7-4-30		Hard	482.3	22.71	13.06	64.23	1.0021	87.89	1.12	9.23
*3B	4	7-1-30											
4A	1	8-2-30	8-4-30		Hard	353.2	17.47	13.25	69.28	1.0342	88.34	1.91	16.42
*4B	1	8-2-30											
5A	1	8-30-30	9-4-30		Hard	609.9	15.21	08.95	75.84	0.9506	88.33	3.43	29.45
5B	1	8-30-30	10-2-30	32	Soft	535.7	16.64	10.04	73.32	0.9744	85.59	4.97	34.54
6A	1	9-1-30	9-5-30		Hard	925.4	13.78	09.01	77.21	0.9455	84.40	5.21	33.39
6B	1	9-1-30	9-20-30	20	Soft	888.1	11.97	4.40	83.63	0.9568	87.52	3.05	24.42

* Never Ripened.

TABLE VIII

SIMMONS AVOCADO ANALYSES

Lake Placid, Florida -- 1930-31

Fruit No.	No. Fruit	Date Picked	Date Tested	Days to Soften	Condition of Fruit	Total Weight (Gms.)	% Seed	% Skin	% Pulp	% Ash	Specific Gravity	% Moisture	% Oil & Fat		% Total Sugar	% Protein
													Green Basis	Dry Basis		
1A	500	3-26-30	3-28-30		Hard	#	#	#	#	#	1.000	83.99	0.61	03.81	2.51	0.94
*1B	500	3-26-30														
2A	7	5-24-30	5-27-30		Hard	182.1	19.34	25.98	54.68	--	1.0179	85.45	0.94	06.46	2.40	1.10
*2B	7	5-24-30														
3A	3	6-14-30	6-17-30	•	Hard	386.3	20.53	16.45	63.02	0.40	1.0121	85.16	3.52	24.44	2.56	1.18
*3B	1	6-14-30														
4A	2	7-5-30	7-11-30		Hard	631.6	19.59	12.83	67.58	0.25	1.0016	87.08	1.36	10.53	2.12	0.98
4B	2	7-5-30	9-20-30	75	Soft	479.6	20.90	12.90	66.20	0.50	0.8773	84.74	3.68	25.36	1.50	1.10
5A	1	7-26-30	7-28-30		Hard	586.8	22.90	10.00	67.10	0.15	1.0005	87.83	2.64	21.20	1.94	1.32
5B	1	7-26-30	8-28-30	30	Soft	530.4	17.70	09.00	73.30	0.21	0.9222	87.55	2.64	21.20	1.04	1.35
6A	1	8-16-30	8-19-30		Hard	670.3	16.30	10.70	73.00	0.29	0.9461	85.10	2.55	17.13	1.98	1.58
*6B	1	8-16-30														
7A	1	9-6-30	9-9-30		Hard	609.3	12.10	09.00	78.90	0.45	0.9244	64.31	14.86	41.60	1.04	1.40
*7B	1	9-6-30														
8A	1	9-27-30	9-29-30		Hard	457.4	15.30	10.10	74.60	0.70	0.9070	78.26	11.51	54.96	1.26	1.91
8B	1	9-27-30	11-2-30	35	Soft	466.0	--	--	--	0.60	0.8219	85.56	06.64	44.63	0.91	2.07
9A	1	10-18-30	10-21-30		Hard	497.8	06.0	09.4	84.60	0.88	0.8633	81.85	09.61	53.62	1.11	1.73
9B	1	10-18-30	12-2-30	42	Soft	509.4	--	--	--	1.48	0.9147	71.78	13.17	50.84	0.68	1.81

*Never Ripened.

#Too small for separation.

†Fruit Spoiled.

(See text pages 81-86)

TABLE IX

LINDA AVOCADO ANALYSES

Homestead, Florida -- 1930-31

Fruit No.	No. Fruit	Date Picked	Date Tested	Days to Soften	Condition of Fruit	Total Weight (Gms.)	% Seed	% Skin	% Pulp	Specific Gravity	% Moisture	% Oil & Fat: Green Basis	% Oil & Fat: Dry Basis
1A	9	4-29-30	5-2-30		Hard	51.00	8.03	18.04	73.92	1.0303	87.90	0.46	2.41
*1B	9	4-29-30											
2A	12	5-31-30	6-2-30		Hard	249.85	9.55	22.91	67.54	1.0113	83.70	0.42	2.55
*2B	12	5-31-30											
3A	4	7-1-30	7-4-30		Hard	462.8	7.67	17.54	74.78	1.0006	89.10	0.66	6.05
*3B	4	7-1-30											
4A	1	8-2-30	8-4-30		Hard	303.0	5.56	17.05	77.40	1.0134	88.01	0.72	6.00
*4B	1	8-2-30											
5A	1	8-30-30	9-2-30		Hard	490.8	8.32	13.90	77.77	0.9883	87.25	2.86	22.46
5B	1	8-30-30	12-11-30	102	Soft	540.0	7.63	10.91	81.46		87.32	3.21	25.11
6A	1	10-1-30	10-4-30		Hard	715.7	8.35	11.73	79.92	0.9714	86.55	4.96	36.85
6B	1	10-1-30	1-9-31	100	Soft	470.0	13.01	15.73	71.26	0.8781	85.94	3.59	25.11
7A	1	11-1-30	11-5-30		Hard	535.7	10.22	16.64	73.32	0.9744	85.59	4.97	34.54
7B	1	11-1-30	12-23-30	51	Soft	467.75	10.96	13.44	75.60	0.9465	86.31	6.61	48.17
8A	1	11-29-30	12-4-30		Hard	734.0	08.54	14.50	76.96	0.9919	77.92	11.26	50.79
8B	1	11-29-30	1-26-31	57	Soft	723.0	12.12	11.26	76.62	0.9618	80.62	9.08	46.91
9A	1	1-1-31	1-3-31		Hard	844.4	11.67	15.22	73.11	0.9661	83.91	8.14	50.60
9B	1	1-1-31	1-11-31	10	Soft	879.6	13.18	13.08	73.54	0.9339	77.04	13.68	59.71

* Never Ripened.

(See text pages 81-86)

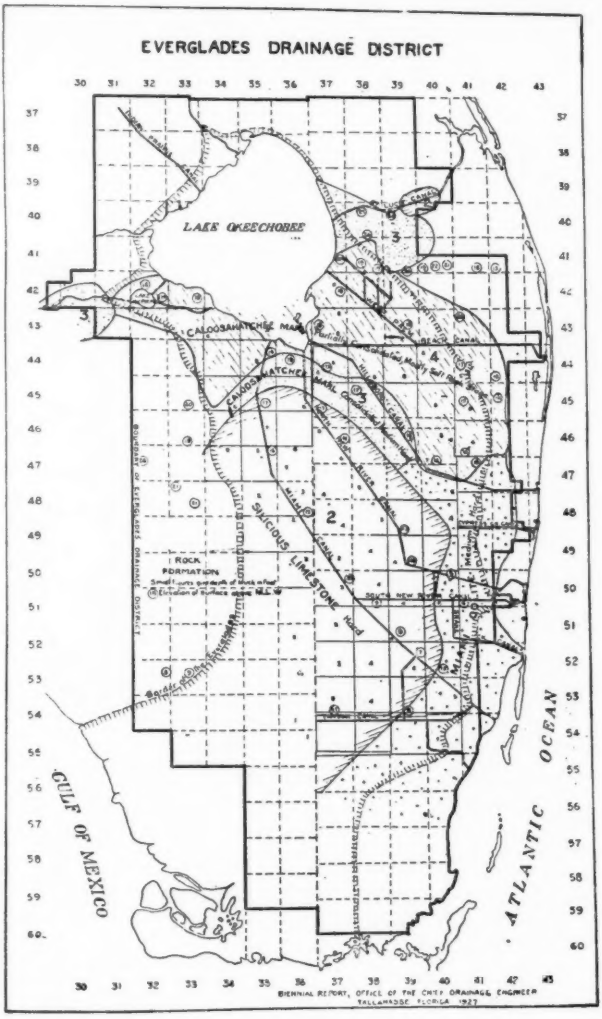

Figure 1.—Map of the Everglades Drainage District showing the general physical layout of the drainage lines together with the general character of the underlying material. (Courtesy of the Chief Engineer.) See Text Page 12.

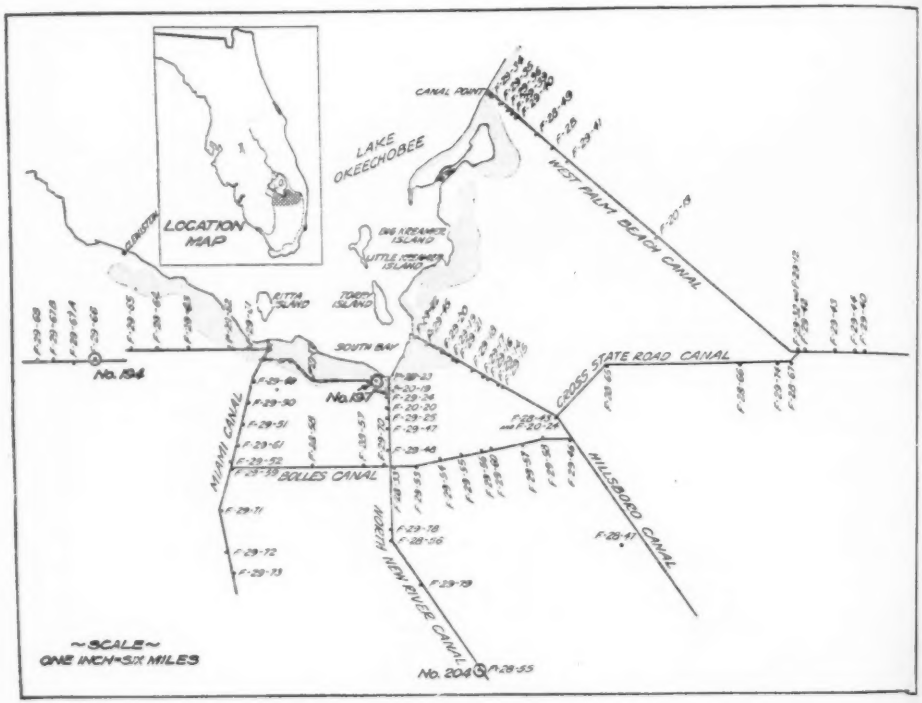

Figure 2.—Outline sketch of the upper glades showing the location of the main canals leading from the lake along the southeast shore as well as the approximate position of the area of heavier Okeechobee muck ("Custard Apple Soil") that occurs as something of a natural levee along this section. See Text Page 13.

Figure 3.—Failure in development of peanuts growing in sawgrass soil through lack of treatment with copper sulfate. Slide No. 12 (89). See Text Page 15.

Figure 4.—Complete failure of corn upon sawgrass land in the upper glades that has been badly burned. Depending upon the severity of the burning, practically all crops fail or are injured in their development upon land in this condition until, in one way or aother, manganese is made available. Slide No. 26 (251). See Text Page 18.

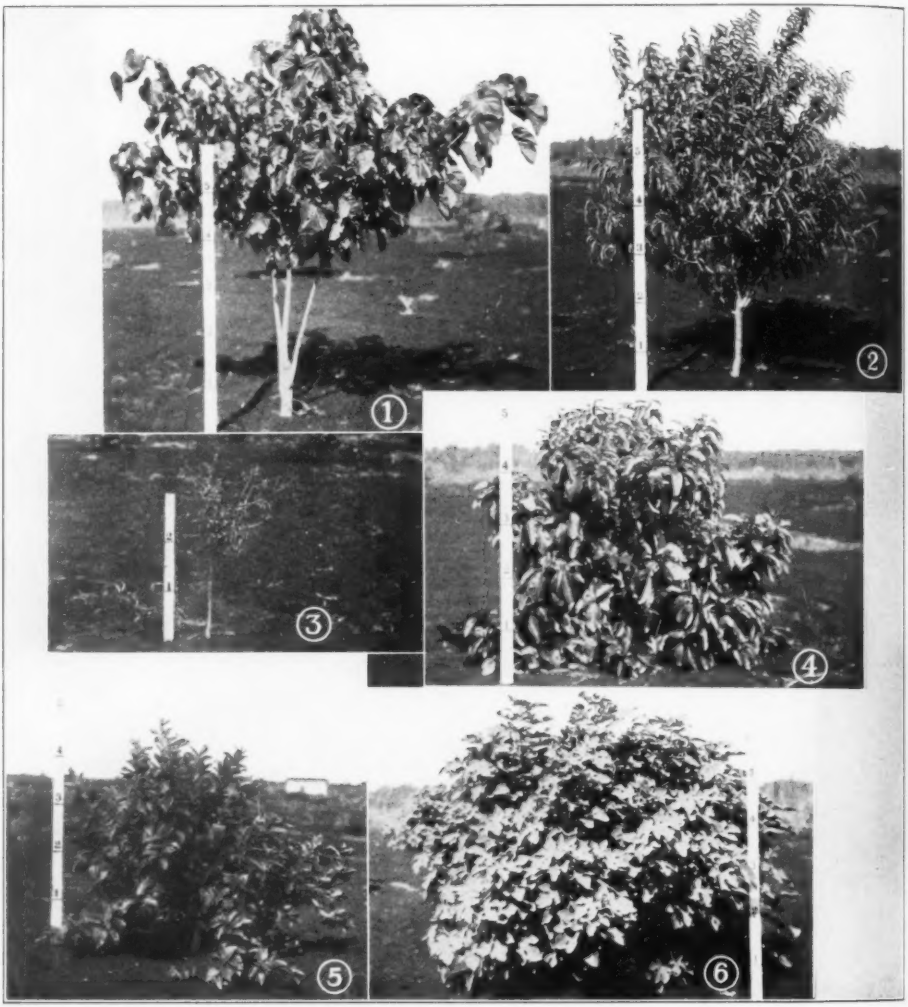

Figure 5.—Series of fruit trees growing on sawgrass soil at the Everglades Experiment Station treated with phosphoric acid, potash, copper and manganese with the exception of No. 5 which is on untreated soil: (1) Tung Oil; (2) Peach (Jewel on plum stock); (3) Avocado (Collinson on West Indian stock); (4) Peach (Jewel) as No. 2 but on untreated soil; (5) Fig (Celeste on fig stock); and (6) Lemon (Villa Franca on rough lemon stock). Part of Slide Series 12-A. See Text Page 15.

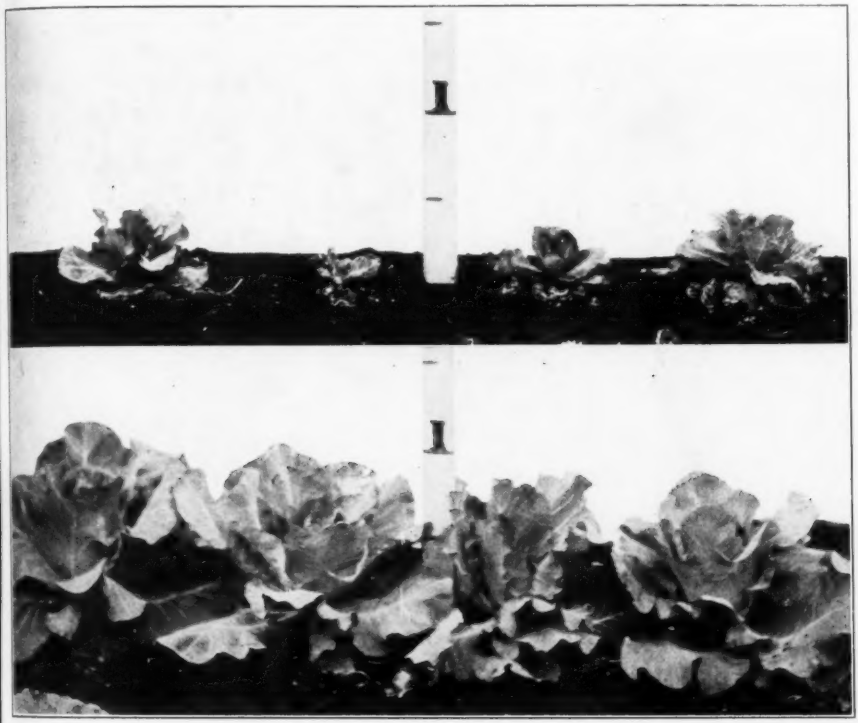

Figure 6.—Failure in cabbage following a series of croppings on muck soil due to potash deficiency. Above: Copper, manganese and zinc treatment without potash. Below: Same treatment with inclusion of potash. Slides 44 and 45 (692 and 694). See Text Page 22.

Proceedings of the Special Meeting of the Florida State Horticultural Society

Held at

Marianna, Florida, Oct. 14 and 15, 1930

At the Forty-third Annual Meeting of the Society held in Sebring, Fla., a committee appeared before the Society that called attention to the fact that practically all of its meetings within recent years had been held in Central or South Florida and asked that a special meeting be arranged to be held in 1930 at a point in West Florida to be selected by the Executive Committee. A resolution was adopted by the Society authorizing this meeting.

In keeping with this action of the Society, a special meeting of the Society was called to meet in Marianna, Florida, on October 14 and 15, 1930. The headquarters of the Society were established at the Chipola Hotel and the meetings were held in the high school auditorium.

The meeting was presided over by Pres. John S. Taylor. Addresses of welcome were made by Mayor John A. Burton and William L. Wilson, and the response for the Society was made by Hon. L. M. Rhodes of Jacksonville.

The opening address was made by Prof. T. H. McHatton of the University of Georgia at Athens, Ga., and is published in full in this Proceedings. Owing to the fact that no stenographic notes were obtained of the meeting, the addresses of welcome and extemporaneous addresses and discussions are not included in the published Proceedings.

The meeting was a very successful one. While the attendance of membership was small, there was much active interest. There is every indication that if these meetings could be followed up regularly, the Society could be of much benefit to horticulture in that part of the State.

Credit for the arrangement of this meeting and the carrying out of details belongs to Assistant Secretary J. Lee Smith of Gainesville and Chas. O. Reiff of Marianna. A local flower show in the parlors of the Chipola Hotel and a motorcade to Satsuma Orange plantings through the county provided entertainment for the guests.

RESPONSE TO ADDRESS OF WELCOME

L. M. Rhodes, Jacksonville

Mr. President, Members of The State Horticultural Society; Citizens of the beautiful and substantial City of Marianna:

We are glad indeed to come to Marianna and West Florida, to meet, mix and mingle with the splendid, progressive citizenship of this part of our delectable commonwealth, so rich in potential wealth, natural resources, and yet unexcelled in scenes of surpassing beauty, abounding in rippling lakes, rivers and bays, crystal springs, babbling creeks, giant moss draped oaks, waxen magnolias, whispering pines and flowers of every hue and fragrance.

We deeply appreciate your cordial words of welcome; we sincerely thank you for your generous hospitality; we feel a deep and lasting

gratitude to you for every effort you have put forth for our entertainment.

I wish to thank you individually and collectively for what you have done for our comfort and pleasure. My own heart, and the heart of every member of the State Horticultural Society, goes out to you for the many fine things you have done and will do, for us while we are with you. We are indeed grateful that this meeting gives some of the best citizens of Central and South Florida an opportunity to learn more of your splendid section.

The ten counties west of the Apalachicola River have an area of 7,619 square miles, more than half as large as Holland, half as large as Switzerland, nearly as large as New Jersey, twice as large as Connecticut, and four times the size of Rhode Island. It is nine-tenths as large as Massachusetts, yet Massachusetts has twenty-one times as many people, and an assessed valuation of more than $6,000,000,000. This shows the potential possibilities of this part of West Florida. When this wonderfully rich section is developed like those states I have mentioned, Pensacola will be a San Francisco, and Panama City and Marianna cities of 100,000 people.

And why not—with soil and climate second to none, with six of these counties bordering on the Gulf of Mexico, the other four connected with it by navigable rivers, with two of the finest harbors south of Norfolk, and Pensacola bay as beautiful as the bay of Naples, and large enough to accommodate the navies of the world, and with a straight sail to a dozen or more rich countries south of us, with millions of acres of cheap land, and building material enough to build a city as large as Chicago, with a health record as good and death rate as low as any part of the United States, and in the same latitude with the land that the Lord said should flow with milk and honey, with advantages legion and disadvantages nil, this potential empire should not be surpassed by a like area anywhere on God's footstool.

But I am about to forget the pleasing proprieties of the occasion: Thanking you again let me say we fully appreciate your sincere and hearty welcome, and accept the hospitality of your picturesque and beautiful city with grateful hearts.

I thank you.

MODERN TRENDS IN SOUTHERN POMOLOGY

Prof. T. H. McHatton, University of Georgia, Athens, Georgia

Fashions change with the passing of years, and what was considered correct a decade or more ago is now out of style. We can look about us on all hands and see these various changes taking place. It should be realized that the kaleidoscopic activities of modern life have not passed the profession of horticulture by. Our business has changed greatly within the past quarter of a century, and still it seems to be in a state of flux, possibly more disordered today than it was some fifteen years ago, because at that particular period we had more or less fixed ideas concerning many of our operations and methods of procedure. Now these ideas have been changed in the light of modern discovery.

Possibly the most outstanding fact of present day horticulture is that it is becoming more scientific with the passing of each season. By this it is not meant that we are becoming more highbrow each year, but that we are looking closer into the whys and wherefores of things and working out annually more practical applications of our knowledge. If one carefully studies the work now in progress in many of our southern experiment stations and colleges, they find this work to be ultra-scientific. A large proportion of it is being done with the microscope and the microtome. We are looking much more closely into the vital function and life processes of the buds of plants, realizing that if we are to produce profitable crops we must be able to set on the boughs of our plants, annually, the necessary buds

for the protection of these crops. Our experimental work with fertilizers, cultivation, general orchard handling and things of like character, has not always given us the results that we desire; and, therefore, those interested in our fields have realized that there is something yet to be learned, and that something dealt primarily with the buds themselves. We are seeking information as to how they are initiated, as to when they develop, and as to the chemical constituents of the plant when this development takes place. We are studying the very "isness of the it," realizing that, if practical success is to be had, we must lay down our fertilizers, and practise our seasons of cultivation, whatever they may be, at just the right and proper time to develop these all necessary buds on our plants. One of the outstanding modern trends is toward truly scientific investigations of plants and their response to environmental conditions. More must be learned about winter killing.

From these studies we have come to some new realization of pruning. Twenty years or so ago it was the general practice to chop and cut trees heavily. Arguing from a study of a very few plants made by one of the outstanding minds of our profession, it was concluded that the heavy pruning of the top of a plant tended toward the increase in its wood growth, and that this heavy pruning had beneficial effects along other lines. Unfortunately, these wide ranging conclusions were drawn from too few experiments, and it was only after experimenters had worked with thousands of plants under many various climatic conditions that it was finally learned that the heavy pruning of a plant disorganized its nutritive balance and was more detrimental than beneficial in the final analysis. Consequently, we are getting away from the old practice of heavy butchering and learning to thin our plants, to open them up and to cut them back only when necessary. Of course there is a difference in the pruning of the different species and no general ruling can be laid down. However, the modern tendency is toward light pruning for openness and for shade. The knife is spared in an effort to rectify physiological and nutritive conditions in our plants. Much more is yet to be learned along this line. Many more mistakes will be made, but I feel that in the light of present information it may be said that future pruning operations will be considerably different and lessened from those of the past.

Studies in root development and in soil moisture content are beginning to change our ideas of orchard cultivation. It has been emphatically stated by many teachers of horticulture that the only way to handle an orchard was to plow it in the early spring, cultivate it consistently once every week or two until the middle of the season, and then to sow, along in July and August, a cover crop that should be permitted to remain on the ground until the following season when it should be turned under by the plow. These statements have been made without fear of contradiction and laid down as the law. These methods are now receiving great questioning. We have reports from pieces of soil that have not been cultivated that have maintained their moisture content better than those which have had a surface soil mulch on them. It must be said that the weeds were killed and all vegetation removed. We have experiments and demonstrations that show that cultivation really loses moisture under certain conditions rather than conserves it. We have studied the roots and the moisture content under sod and under sod-mulch and found that trees did well and that the moisture was maintained under conditions that many years ago were thought to rob the plant of moisture.

We see orchards that are covered with heavy growths of kudzu, maintaining their vigor, producing bountiful crops and, to all appearances, being better than those just across the road where the old system of cultivation and summer and winter cover cropping is carefully followed. No longer are we willing to lay down the law that just this or that or the other should be done. Right now our ideas of orchard handling in the South are up in the air, and before anything definite can be said about it, considerably more investigation must be done, and by this I do not mean demonstrations; I mean careful, consistent study of basic scientific facts, and after this information has been obtained we may be able to work out a satisfactory method of

general orchard cultivation and management. The results that have been obtained in the soils and under the climatic conditions of the East do not seem to hold true for the hot and humid conditions of the South.

Our respect for organic matter is constantly on the increase. We have seen its presence in soils correct disease conditions in trees. We are now watching with a great deal of interest the development of Crotalaria, Austrian winter peas and other cover crops and the use of mulches of pine straw and such material in the orchards of the South.

Possibly nothing has changed to a greater extent than spraying. The increase in pressure has been notable. For one who has lived in the South since the very dawn of this spray business, it is marvelous to note what has happened; from the simple barrel pump to the power outfit, and then to the duster, and from that to the aeroplane, and now back again to an outfit giving from 400 to 500 pounds nozzle pressure, and in many instances to the stationary outfit piping the material through the orchard and giving rapid and successful results, cutting down labor and time to a minimum, putting spraying on a basis where it can be done even though the ground under foot is wet and soggy, giving the growers the opportunity to rapidly get over large orchards independent of spray tanks, water hauling and mules. It may also be said that the time will come when practically every orchard of size will be handled by a central spray outfit from one location. We may even visualize a central community spray outfit where all the grower will have to do will be to turn on the valve from the general main to his orchard lines and start the hoses.

Our machinery is changing. The poor old mule is rapidly disappearing and in his place we have the tractor; and, should we cut down on the cultivation and install central spray systems, the machinery problem on the fruit farm becomes so greatly minimized that we pass it over and recognize that in it we have reduced our overhead, increased our day's work and greatly heightened our efficiency.

Economically we are viewing things differently. Quality production means more than quantity and is the topic of discussion for the day. We have learned that we cannot produce under protection and sell on the open markets of the world at a profit. We have learned that the great economic principles followed by big business concerns must also be followed by agriculture if we expect to survive. Just how far the southern farmer and fruit grower are going to be brought together in large organizations for the controlling of production and the distribution of products remains yet to be seen. There is something in the psychology of the South that is opposed to gathering together in masses and being led by a few.

Constantly we are looking for new crops. Just before us is the development in the blueberry. Will we learn to handle it from the experiences of the past, or must it go through the same period of over-advertisement and heated excitement that has attended the apple in the West and the pecan in the South? What about the possibilities of our fig production? Have we thought sufficiently of it, and may we ask what is going to be the future of our pecan?

Speaking of pecans, this crop shows more of the modern trends along horticultural lines in the South than any other. It has recently been organized into a national commodity association through the efforts of the Federal Farm Board. This organization was perfected following investigations of conditions by the Farm Board and the calling of a meeting in Washington for organization purposes by interested growers and representatives of existing co-operative associations. These committeemen harmonized the industry and organized directly under the auspices of the Federal Farm Board the National Pecan Marketing Association, which has representatives all through the South. It has already established numerous local co-operative associations, all doing business through the National Association. The pecan is among the first horticultural products of the United States to take advantage of the opportunities offered by the legislation recently passed by our Congress. It is organized just exactly the way the Federal Farm Board wants it organized, and it has everything back

of it to make a success out of its business. This organization demonstrates the trend of our present southern pomology toward co-operation and follows the principles of economics as laid down by big business.

The fruit grower must become a financier; he must be a scientist in the truest sense of the word, and by this I mean a man who applies the fundamental principles and laws of science to the profitable and economical production of a crop. The trend of modern things is toward the development of an entirely new type of fruit growing. Another twenty-five years will so have changed the face of the map of horticulture that those of us, working today, will find ourselves much in the same position as we do at the present time trying to keep the new countries of Europe straight, following the great war.

TUNG OIL

Harold Mowry, Florida Agricultural Experiment Station, Gainesville

The growing of tung-oil trees is probably creating more interest than has any plant introduction of recent times. This interest is not confined to Florida alone but is evidenced in some of the other southern states as well as by persons in northern states who would grow the tree in the south. The present interest in tung-oil growing and the initiation of commercial plantings of today had their inception in some plantings made at Tallahassee and at Gainesville on the test grounds of the Experiment Station. Due to the very promising showing made by the trees at the latter place an acreage planting was first made in the Gainesville area in 1923 which was followed shortly thereafter by others. Since that time there has been a mounting increase in plantings in the state that has brought the present total to approximately 5,000 acres. In addition to the grove acreage there are now some 2,000,000 nursery trees available for planting this coming season. Reports from other states have indicated a field acreage of between 1,500 and 2,000 acres in Georgia, Alabama, Mississippi and Louisiana.

The greater portion of the Florida acreage is in Alachua, Levy and Clay counties. There are numerous smaller plantings in other northern and central counties and a few in the southern area.

Just what the range of adaptability of the tung-oil tree will be in Florida or in the South is not yet known and will not be definitely determined until such time as properly-cared-for test plantings are made in all sections. The Experiment Station in past years has sent out numerous lots of seed and some nursery stock for testing purposes. Reports from these test lots and other plantings have shown the tree to make a satisfactory growth in many of the counties north and west of Marion county. Some counties had no plantings and others furnished no reports. This would indicate that the tree, from present known information, can be grown in most counties of north central and northern Florida. It does not by any means necessarily indicate, however, that the tree is adapted to all locations and soils within that area. Neither would the failure of a planting in some vicinity mean that other soil types or locations adjacent would not be adaptable. Most failures reported have been from either a lack of the necessary care or from poor drainage conditions. Plantings have recently been made in some of the more southern counties which should later give definite information relative to the adaptability of the tree to that portion of the state.

The northern range of the tung-oil tree will be determined largely by minimum winter temperatures. Trees at Gainesville have withstood fifteen degrees F. when they were in a dormant condition with no apparent injury. Sudden drops of temperature to below freezing in early fall or spring have a tendency to do more injury than do much lower temperatures in mid-winter. Damage to blossoms has occurred in some instances by freezing temperatures following periods of warm weather in late February or early March. It is important in this connection that sites having good air drainage be chosen for planting.

Tung oil, also termed wood oil, is the oil expressed from the seeds of *A. fordi*. Before crushing, the oil in the seeds is almost colorless and after expressing is of a very light amber color. American oil is much lighter than the imported and is by nearly everyone considered to be superior to the Oriental product. It has a wide variety of uses. In America, one of its chief uses is in varnish where it is combined with rosin, this combination having replaced the use of imported fossil gums. It is also used in large quantities as a waterproofing material for silk and other fabrics; as well as masonry; as a leather dressing; for the insulation of electrical equipment such as cables, dynamos, etc.; for the making of linoleums and oilcloth; and in the automobile industry on gaskets, brake linings, and as an undercoat for automobile body finishes. When burned to a soot, it is used in the manufacture of India ink. During the year 1929 over 119,000,000 pounds of tung oil were imported into the United States, this being almost three times the amount which was imported in 1918. The valuation of the 1929 importation was almost $15,000,000. The average valuation per pound was about twelve and one-half cents.

The tung-oil tree is a native of China. It was first introduced into the United States in 1905 when some seeds were sent to Chico, California, and to Florida in 1906 when some small trees were sent to Tallahassee by the U. S. Department of Agriculture. Evidently the tree is not adapted to the California conditions as no plantings have been made there. Little is yet known as to the longevity of the tree under Florida conditions. The first tree was planted in 1906 in Tallahassee and is still living, which shows that a life of at least twenty-five years can be expected. At maturity the tree attains quite a large size, reaching a height of twenty-five to thirty feet or more with a spread of approximately forty feet. The tree is deciduous, shedding its leaves in November and remaining in a dormant condition until late February or March. Its blossoms, which usually appear before the leaves in the spring, are borne in clusters and are of separate sexes, there being about sixty or more male flowers to one female. The fruits which ripen in October and November are shaped something like apples and drop to the ground at maturity. A normal fruit contains five seeds.

The tung-oil tree, botanically known as *Aleurites fordi*, belongs to the Spurge family, this being the same family in which are placed the common castor bean, the poinsettia, and several other plants which are grown in Florida. There are five species of *Aleurites*, all producing an oil which has a greater or lesser value as a paint oil. At present none other than the tung-oil, *Aleurites fordi*, is being grown in a commercial way in Florida, although a few trees of other species are growing in the southern part of the state. None of the other species is as hardy as *fordi*.

There are yet no named varieties of the tung-oil trees. Several differences have been noted which will probably lead to a naming of varieties in the future. These differences have to do mainly with the shape or size of the fruit and the number of seeds contained, or the manner in which the fruit is borne at the end of the twig. Some trees produce most of their fruits in clusters at the twig ends while others produce only a single fruit at this position. This difference has led to the tentative naming of "single" and "cluster" type or varieties. Averages of the yields of all trees at the Experiment Station over a period of three years have been in favor of the cluster trees. The largest tree, however, and the one which has produced, as an individual, the greatest amount of fruit is of the single type. That there are differences in trees as to the maximum yield is shown by tree records kept at the station over a period of several years. Some of the trees are consistently heavy bearers while others are as consistently shy bearers. From these records, it is indicated that it is highly advisable in planting seeds that only seeds from trees having a good yield record should be planted. It is not yet known what percentage of seedling trees will come true to the parent, but it is obviously a good practice to plant seeds from trees of known satisfactory parentage. Experiments have shown that the tree can be very satisfactorily budded, making use of either the patch or shield bud. Plantings have been made at the Experiment Station to

compare budded trees with seedlings of known parentage. When these come into fruiting, it should demonstrate whether or not budding should be practicable. Along this line it is well to bear in mind that in America there are no commercial plantings of large size of seedling fruit or nut trees.

Yield records of mature trees on an acreage basis are not yet available as no acreage plantings in America have reached maturity. Any figures given for such must necessarily be based on either conjecture or the yields of older individual trees. There are ten trees on the test grounds of the Experiment Station that have an average age of about sixteen years. These trees are spaced but ten feet apart in the row and have had no especial attention other than regular fertilization of ten pounds of commercial fertilizer per tree annually since 1923. During their first eight years they had little or no fertilization. The trees, of course, are unselected seedlings. Some yield good crops regularly and others as consistently bear little. They have averaged for the eight-year period of their ninth to sixteenth years an annual yield of seed equivalent to slightly less than one gallon of oil per tree. Some have considerably exceeded this average while the balance in the same ratio have been below it.

The tree is one which to a large degree thrives in ratio to the fertility of the soil on which it is planted. Dr. R. M. Barnette of the station has found a very close correlation between an excess of phosphate or lime in the soil and a poor growth in the trees. In view of this, it would seem advisable, at least for the time being, to limit plantings to soils which do not contain an excess of these minerals. Both the higher lands and the flatwoods soils are being planted, the trees with proper cultural attention making a satisfactory growth on both types. Thorough drainage is an absolute essential. The trees on undrained lands, with a high water table, may make a thrifty growth for a year or so but as the roots penetrate to the water table, the growth will be checked.

Propagation is by seeds, they being planted in a nursery at a depth of three or four inches, spaced eight to twelve inches in the row with the rows about three and one-half to four feet apart. February has been found to be the best time for seed planting. The soils in the nursery should be regularly cultivated so that all weed and grass growth is destroyed. Only shallow cultivation should be given. The use of stable or chicken manures in the nursery will tend to promote growth as will also light top dressings of nitrate of soda. The site selected for the nursery should be fertile and one which is well drained but at the same time holds adequate moisture throughout the summer months.

Transplanting should be done only while the trees are in a dormant condition and, if possible, should be completed by mid-February. Various field spacing distances are used, but the larger portion of the acreage has been planted with a spacing of twelve and one-half feet by thirty feet, which gives approximately 116 trees to the acre. During its first few years, it seems advisable to give the trees regular shallow cultivation during the spring and early summer months. This cultivation can consist of only a narrow strip on either side of the tree, the middle being planted to some suitable cover crop.

The crotalarias have proven themselves well suited as cover crops for the tung-oil tree. Their first cost is very low and with one seedling it is possible to have voluntary crops for an indefinite number of years thereafter.

Fertilizer tests have shown that a complete fertilizer is required for maximum yields and tree growth. The best results were obtained from one analyzing five per cent nitrogen, eight per cent phosphoric acid and four per cent potash. This has been applied at about the rate of one pound for each year of age for the tree. Stable and chicken manures are valuable but will probably have to be supplemented with some additional phosphoric acid and potash. Peruvian guano has been used with very good results.

Little pruning after transplanting has been done other than for the purpose of removing interfering, broken or dead branches. A much better growth in most instances has resulted when the trees were severely cut back at the time of transplanting. Often when nursery stock is trans-

planted, unpruned, the trees fail to make a satisfactory growth following, but when cut back to eight or ten inches above the soil surface, vigorous growth follows.

Harvesting simply consists in picking the fruits up from the ground. They can remain where they fall for several weeks without deterioration but if left too long there is considerable chance of losing a large portion of them by their becoming covered with the soil. Present oil-expressing machinery does not require that the fruits be hulled by hand. The whole fruits, dried, are decorticated by a huller, the seeds then ground into a meal, and meal fed into a press. By means of tremendous pressure the oil is squeezed from the seeds and, after settling, is ready for market and use. There is but one such mill in the South at present, this being located in Alachua County near Gainesville. The press cake resulting from the expression of the oil has a potential fertilizer value, it containing nearly six per cent nitrogen and comparing favorably with castor pomace in this respect.

Few insect pests or diseases of consequence have been noted as affecting the tung-oil tree. Those observed thus far include root-knot, cottony cushion and Latania scales, thread blight, and a bacterial leaf spot. Root-knot seemingly does not seriously affect older trees but may be the cause of considerable stunting in nursery stock. This pest can be largely overcome by locating the nursery on new soils, or on those soils which have not grown hosts of the root-knot nematode in recent years. Nothing other than root-knot-free nursery stock should be planted. The scale insects mentioned have not yet made their appearance in such numbers that commercial spraying has been required. The diseases noted cannot at present be considered of any great importance.

Indications point to a large increase in acreage this winter. Greatest returns will probably be from large acreages on low-priced suitable lands where overhead costs are kept to a minimum. Plantings of a few acres would best be grown only as a side crop and not as the chief source of income. It would seem from present information that tung oil offers a paying crop for much land that is now producing no revenue.

THE GRAPE INDUSTRY IN FLORIDA

E. L. Lord, College of Agriculture, Gainesville

Through some inadvertance my name was left off this program. If I followed my own inclinations, I would have been very well satisfied if I had not been allowed to speak, as I enjoy these meetings much better when I do not have to worry about an address, but can enjoy the personal associations which make a meeting like this so valuable.

The history of the grape industry in Florida is similar to that of the remainder of the United States. The Spanish brought the Wine Grape to Saint Augustine, but failed in establishing profitable vineyards, owing to the inroads of phylloxera and disease. About fifty years ago a company was organized at Orlando for the purpose of growing the Niagara grape commercially, but the experiment was abandoned after a few years, because of the short life of the vines, the high cost of transportation and the difficulty of preventing loss from decay in transit.

Later the U. S. D. A. carried on experimental work at Earlton under the supervision of Baron V. Luttichau. These also failed to furnish information to justify commercial planting of these varieties.

As all of you know the trouble with these varieties is due to the fact that they come from drier areas where they are not subjected to the humid conditions of our summer, and the fact that they are not resistant to diseases and damage from phylloxera. This condition seemed unsurmountable until T. V. Munson of Denison, Texas, produced varieties which contained a large percentage of native blood.

About a decade ago some of Munson's varieties were extensively distributed over the state,

and certain of them, especially the Carman and Beacon have succeeded so much that they have been widely planted. These plantings have been in some cases quite successful, but due to the fact that the Florida grower was unfamiliar with the peculiar cultural requirements of the vine, and particularly with that of these varieties, grape culture has often been a failure in the state. This has been due mostly to the selection of poor sites and soils or of wrong varieties, although it has often been to improper culture or insufficient care. The high rolling land which is suited to grape culture is often deficient in organic matter, and this deficiency must be made up by the use of bulky manures, or by a system which produces heavy cover crops. When this is done heavy crops of good quality are produced at a low cost, and profits are assured if the market is available.

While the Montverde section in Lake County has made the most extensive plantings; this has not been because they could produce grapes more cheaply or better than you growers in Western Florida; but because they are able by bringing their grapes on the market earlier to avoid more easily the heavy competition from Arkansas and California. What the Florida industry especially needs is the fundamental plant breeding towards earliness; varieties are already in existence which ripen in May, and by hybridization it is perfectly possible to produce early varieties which will be of good commercial quality, and which will have the resistance to our especial conditions. As a matter of fact the future of pomology depends primarily on the production of new and better varieties, as well as upon the introduction of old varieties into new areas. Many problems in horticulture which have appeared unsurmountable have been sidestepped by the appearance on the horizon of new varieties.

At the present time the two most widely planted varieties are the Beacon and the Carman, but as the popularity of any variety is usually a matter of only a few years, the grower should keep in touch with the variety question, so that he can take every advantage that is offered. While West Florida can and will produce grapes more cheaply than the peninsula, especial effort should be made to use the juice in as extensive a way as possible. Frozen juice seems to offer fully as satisfactory a way of disposing of the crop as the old way of fermenting it. In investigating the use of grapes for juice it might be well to investigate the possibilities of the varieties of the Rotundifolia group, especially the Thomas, which is probably the best one of this type for the production of by-products.

If the grape culture in this part of the state is to be largely developed from the standpoint of grape products, it is important that the grapes be produced as cheaply as possible. There is no doubt in my mind that this aim can be most easily achieved by lessening cultivation, increasing the use of nitrogen in the vineyard and growing covercrops which will add the much needed organic matter. In Lake County there is a marked difference in the behavior of the vine where Crotalaria is grown in the middles. The fruit is better in quality, ripens earlier, and the vines are more vigorous. It is a truism among the grape growers of the North that the life of the vineyard depends upon the amount of organic matter in the soil. The heaviest yields that I have seen in the state were in vineyards which have been growing Crotalaria for two or three years. One such vineyard has had repeatedly heavy crops, some running over five tons to the acre. It may be possible to grow the Crotalaria near the vineyard and haul it in. In all of the experimental work that has been done in the use of Crotalaria as a substitute for stable manure the yields were higher from the same tonnage of Crotalaria applied to the soil than they were from stable manure. T. V. Munson recommended the application of stable manure regularly to the vineyard. With the present high cost of manure such treatment is prohibitive in cost, but it seems that in Crotalaria we have a very efficient substitute.

In conclusion, the grape industry has suffered severely from a too rapid extension of plantings; the increase has been much more rapid than any economic condition could justify. Although I have been president of the Florida Grape Growers' Association for the last six years, and have done everything in my power to help the grower

with his problems, I have never recommended that he plant a vineyard, as I fully realize the hazards that attend any horticultural venture. However, if all of the conditions which the culture of the grape demands are met, and the increases in acreage are kept down to a reasonable level, the market for Florida grapes can be gradually increased so that they can be grown at a profit by as large a per cent of growers as can be found in any other horticultural industry.

THE SAND PEAR

H. G. Clayton, Gainesville

The Florida State Horticultural Society has performed a real service to the Horticulture of our State in many ways, only one of which I will mention at this time, and that is through its printed Proceedings, where we have a fairly complete record of much of the horticulture of the State—particularly such as applies to citrus and sub-tropical plants. Florida horticulture differs materially from that of other states and it is important that in its development there be some means of recording this development in order to make the data available and that the records be kept. A good part of the horticulture of the western part of the State is not yet recorded in the Proceedings and this meeting is the beginning, I trust, of getting much additional information disseminated and properly recorded.

In the discussion of the topic assigned to me, my effort will be to make a beginning as there are many men in this area and in this audience better qualified than myself to handle this subject. As time goes on, we will have the benefit of their knowledge and experience recorded in the printed Proceedings of the Society.

The principal classifications of pears grown in this country are the *European Pears,* (Pyrus Communis), of which the Bartlett is the leading variety—the *Oriental Pears,* (Pyrus Sinensis—Pyrus Serotina), commonly called Sand, Chinese and Japanese pears, and the *Hybrid pears,* such as Le Conte, Kieffer and Garber.

Hybrid Pears:—The LeConte was introduced into Liberty County, Georgia, about 1846 in a shipment of plants sent by Major John LeConte to his niece, Mrs. J. L. C. Hardin. This shipment came from the nursery of Thomas Hogg. Mr. Hogg secured the pear tree in this shipment from Ferdinand Potter of Providence who secured it from the Prince Nursery of Flushing, Long Island. The Prince Nursery introduced the pear from France about 1840 and listed it in their catalogue of 1841.

After the Civil War, there were large plantings of LeConte pears in the South. The industry grew and developed rapidly until the pearblight came in and practically paralyzed the industry within a short time. Following this (1880-1890), the Kieffer was extensively planted in the South as it was thought at that time to be much less subject to blight than the LeConte but this, however, later proved to be incorrect. About this time a large number of Garbers were also put out by nurserymen.

Oriental Pears:—In 1854 S. F. Smith of Marietta, Ohio, received from New York an oriental type, called Cincincis. Mr. Smith is recorded as being the first nurseryman to raise and offer for sale this new race of pears. This pear has been grown around Fruitland Park, Florida, for many years, being introduced and grown on considerable scale by a son of Mr. S. F. Smith.

The Oriental Pears are not greatly in favor in Europe because of their poorer quality. Because of their vigorous growth and beauty, however, they are used as ornamentals. In the United States, because of the vigorous growth, early and regular fruiting habits, disease resistance and wide range of adaptability, the Oriental Pear is given first place in regions not well adapted to common pears and is a competitor in localities suited to both the Oriental and Common.

There are many varieties of Oriental or Sand pears being grown in Florida.

Pineapple: This pear, according to Woodroof of the Georgia Experiment Station, has been called Chinese Pear, Chinese Sand Pear, Japanese Sand Pear, Hybrid Sand Pear, Florida Sand Pear, Sand Pear, Bull Nose Pear, Banana Pear and Pineapple Pear. The first description of a pear that fits the description of the Pineapple Pear that Woodruff could find was described before the American Pomological Society by H. H. Stanford of Thomasville, Georgia, who in 1875 described twenty-year-old trees. The first appearance has not been determined and trees thirty to forty or more years old are located in South Carolina, Georgia, Florida, Alabama and Mississippi. There is probably more available information on the Pineapple than any of the other varieties in this group of pears.

Hood: From a seedling at Loretta, Florida, is an early pear ripening in June and July.

Shaw: From a seedling tree growing on Texas Hill, at the forks of three roads near the Shaw place at Monticello. Mr. Shaw either dug this tree or propagated from it. Fruit somewhat lacking in size—quality good.

Baldwin: This originated in Baldwin County, Alabama, from one seedling of a group planted fifty years ago by the chef at the old "Battle House" in Mobile. This is a variety only recently distributed.

Brewton: There is an old planting of Sand Pears in Escambia County, known as the Brewton place and these pears are known locally as "Brewton Pears."

The *Foster, Apple, LeConte Seedling*, and other varieties—among which are a number introduced by the U. S. D. A., and which are not yet named—are being tested out.

At the Florida Experiment Station, forty varieties of Sand Pears are under test. This test has only been under way for three years so it is too early to expect results. Georgia had forty-five varieties of pears in test plots in 1932—a number of which were Sand pears. In 1922 when they were ten years old, only seven varieties out of twenty-seven varieties in the test were classed as showing no blight.

With all this array of varieties, it would seem to me that there is yet much to be done to select the best adapted varieties. Our pecan growers have been through the variety stage of the industry and have finally reduced the list considerably and the industry is best off, in this respect, than ever before. The citrus growers have gone through the same thing. It is my belief that the efforts of this Society can bring together information that will help the pear industry. At the present time, the Pineapple Pear is planted more generally than any other variety in the recent plantings although some of the varieties lately made available to growers will afford plenty of future competition for the Pineapple variety.

Without going into details of propagation and culture further than to say that cuttings, budding and grafting may all be used successfully—cuttings require a longer time to develop a good root system than budded or grafted trees. Mr. Mowry of the Florida Agricultural Experiment Station is of the opinion that the Japanese stock is to be preferred to other stocks for budding and grafting. Trees budded on this stock grow off rapidly and develop a strong root system.

One or two considerations appear to me to stand out in the future of the pear industry in Florida.

(1) There appear to be none of the common pears which are adapted to our soil and climatic conditions so we must use the best of the Oriental varieties which means they will be used largely as cooking and canning pears. With the present increase in canning in connection with the citrus industry, there may be an opportunity to interest some of the canners in a pear and blueberry canning proposition.

(2) It is to the interest of the pear industry to secure early maturity for the greater part of the crop. Statistics of the U. S. D. A. show that pears are marketed in the United States as follows:

May	.1 Per cent
June	.4 Per cent
July	7.5 Per cent
August	25.1 Per cent
September	44.4 Per cent
October	21.5 Per cent
November	1.0 Per cent
	100.0 Per cent

The pears marketed in June and July will have little competition.

Pears to mature early should bloom early and since blight is transmitted to considerable extent through the blossoms, early blooming varieties have an advantage in that insects feeding in these early blossoms cannot bring infection from other varieties. Of all the southern states, Florida is least susceptible to frost damage and early flowering would be safer here than in other southeastern states.

(3) In western Florida, especially, I believe the Sand Pear offers an opportunity in horticulture. At present the greater part of the plantings have not reached anything like full-bearing age and there is plenty of room for additional plantings to insure car-lot shipments. The pear is one of the easiest of all horticultural crops to grow and one of the cheapest, both from the standpoint of nursery stock as well as cultural methods. Any farmer can well afford to set out a number of trees around the farm for shade and stock feed, to say nothing of a market in the state for more than are being produced at present and the markets of the United States open for the early maturing kinds that ripen in June and July.

I have not attempted to cover all the things that could be said of the Sand Pear in this short paper but have tried to sketch a few points in connection with this horticultural crop.

PLANT QUARANTINES

J. C. Goodwin, Nursery Insepctor, State Plant Board, Gainesville

There is much confusion apparently in the minds of many of our citizens as to just exactly what the duties and functions of the various state supported agricultural activities are. Therefore, it is my intention to briefly outline what the state government is doing in support of Florida's agriculture and through what agencies it acts.

To begin with, the Department of Agriculture is presided over by an elected cabinet officer, the Commissioner of Agriculture. The activities of the Commissioner of Agriculture are varied and are not restricted by any means to agriculture itself, for the Commissioner is a member of numerous administrative boards created by legislative action. In a general way, the Commissioner exercises supervision over the collection of statistical material bearing upon agriculture, issues bulletins of one kind or another, administers the food, insecticide, fertilizer, gas and oil inspection, green fruit and other special laws bearing upon agriculture.

The agricultural educational activities of the state are directed through the agricultural college and experiment station at Gainesville. These are parts of the University of Florida. An important branch of the agricultural college is the extension service which includes the county agents and the home demonstration agents. These men carry to the farmers and the farmers' wives the information which has been accumulated from all of the sources and which may be helpful to the farmer. Research work is carried on through the Agricultural Experiment Station. The main station is at Gainesville, with branches and laboratories in different parts of the state where special attention is given to studies having relation to the production and protection of crops. The educational and research organizations operate, of course, under the general supervision of the State Board of Control, which likewise has supervision of the Women's College at Tallahassee and the school for deaf and blind at St. Augustine. The Agricultural and Mechanical College for negroes at Tallahassee is likewise under the jurisdiction of the Board of Control.

STATE PLANT BOARD

Regulatory work in connection with the movement of plants and plant products is handled by the State Plant Board. In order that you may secure a comprehensive view of the origin and functions of the Plant Board, we will have to go

back to 1912 and 1913 when citrus canker was first found in this state. Dr. E. W. Berger, nursery inspector in 1912, discovered a peculiar disease on some grapefruit trees at Monticello and specimens submitted to the Department of Agriculture at Washington were reported on as being affected by scab. In 1913, this same disease was discovered in Dade County and efforts to control the disease by spraying proved a failure. The Florida Growers and Shippers League, under the able leadership of Lloyd S. Tenney, became interested in the peculiar condition and donated money towards an eradication program. It was soon found that the funds available were insufficient and an appeal was made to Legislature in 1915 and the plea for assistance was met by the passage of the Plant Act of 1915, creating the State Plant Board and appropriating funds for its use. The Act creating the Plant Board provided for the Board of Control to act as a Plant Board. The first meeting of the Board was in May of 1914, and Dr. P. K. Yonge of Pensacola was elected Chairman of the Board. At the second meeting of the Board in May of 1915, an executive officer was provided for and the work of the Board was divided into several departments, namely, Citrus Canker Eradication, Nursery Inspection, Plant Pathology and Entomology. The work of the Quarantine Department was carried on in connection with other minor activities of the Board. This Department was later created and functioned as the Port and Railway Inspection Department of the Plant Board. Subsequently the name was changed to Quarantine Department. The Plant Act was amended and re-enacted in 1927. It may be well said that the emergency created through the finding of this new and strange disease in the State of Florida was the direct and immediate cause of the creation of the State Plant Board. Now that we have a background of the Plant Board, let us indulge in some observations on the several departments of the Board.

GROVE INSPECTION DEPARTMENT

I have mentioned the fact that the Plant Board was divided into five divisions, Canker Eradication, Nursery Inspection, Plant Pathology, Entomology and Port and Railway Inspection. The Canker Eradication Department, now known as the Grove Inspection Department, was and has been responsible for the work of eradicating citrus canker in Florida. It is the belief of the speaker that all of my hearers are fully informed as to the success which has attended our efforts so far in eradicating this disease. Although inspectors have from time to time found canker, it has not been allowed to spread from the locality where found and no outbreak approaching anything like the proportions of the first has occurred.

You may ask what has that to do with North and West Florida. One of the first varieties of citrus to become infected with canker was the satsuma. The disease was probably introduced into Florida on citrus trifoliata stock and you all know that canker occurred in three counties in this section of the state. Along with other areas in the state, eradication campaigns were carried on in this part of Florida and undoubtedly canker would at this time be a very serious handicap to the growing of satsumas if the disease had not been eradicated. Our grove inspectors make a complete inspection of all satsuma and other citrus plantings about every two years. They not only look for canker but, being trained men, are on the lookout for any new plant pest which may become established.

PLANT PATHOLOGY

The pathological work of the Plant Board is very closely connected with the work of the Experiment Station. The research work of the Board on citrus canker has been carried on by Professor H. E. Stevens, then later by Dr. O. F. Burger, and at present under the able leadership of Dr. W. B. Tisdale.

QUARANTINE DEPARTMENT

The Department of Port and Railway Inspection, provided for when the Plant Board was organized, is now known as the Quarantine Department. Inspectors are stationed at Pensacola, Jacksonville, West Palm Beach, Miami, Key West and Tampa. The duties of these inspectors con-

sist in searching every incoming boat for the presence of any thing, especially plants and plant products, likely to bring in new plant pests. They also meet all incoming trains in order to hold up and inspect all nursery stock and plant products which might harbour plant pests. A few of the pests which are not known to be established in North and West Florida are the Pink Boll worm of cotton, the Argentine ant, the Japanese camphor scale, and it is always possible that citrus trees infected with canker may be shipped into this area. It may be of interest to my hearers to learn that the Argentine ant and the camphor scale have been intercepted at Pensacola.

Your speaker is not a believer in the use of a mass of figures because it generally causes confusion in the minds of the listener, but a few figures must necessarily be used at this point to show the volume of work done by this department during the fiscal year ending June 30, 1930: The inspectors at the several ports in the state have had an increasing amount of work each year, and last year was the banner year. Four thousand six hundred and eighty-four boats arrived at Florida ports from foreign countries, all of which were potential, and some were actual carriers of dangerous pests. During the year the inspectors at the ports handled over three million parcels containing plants or plant material, and the dreaded Black Fly was intercepted twelve times and the Green Scale forty-nine times during the twelve month period.

NURSERY INSPECTION

As you all are aware, North and West Florida is a long narrow strip of territory with Georgia and Alabama immediately on the Northern and Western boundary. All of this area is left unguarded with the exception of Pensacola. We have been unable to station men along this border to inspect plants and plant products due to the lack of men and money to carry on the work. We have therefore depended on nursery inspection as a means of looking for pests which may enter and become established in this territory. You can readily see that nursery stock could be the means of scattering a plant pest in a very short time. We make inspections of all nurseries in North Florida every three months. In order to give you an idea as to the extent of the nursery business in this section, I want to present a few statistics. According to figures taken from our inspection reports, there were the following number and kinds of nursery stock in nurseries in the area from Escambia to Columbia Counties on June 30, 1930:

Pecan 561 acres and 3,234,453 trees.
Pear 8.50 acres and 45,237 trees.
Blackberry 2 acres and 12,000 plants.
Blueberry 52 acres and 216,000 plants.
Grapes 21 acres and 107,000 plants.
Tung Oil 2 acres and 11,000 plants.
Ornamental and other stock 132 acres and 1,056,120 plants.
Satsuma 164 acres and 910,000 plants.
Other citrus trees 3 acres and 10,500 trees.
Citrus Trifoliata 20.5 acres and 426,000 trees.
Total acres 766; Total trees and plants 6,028,300; owned by 190 nurserymen.

These figures are for the area from the Western boundary of Columbia County to Escambia County.

APIARY INSPECTION

In addition to the work that the Plant Board has in connection with the movement of plants, we are also invested with the administration of the Bee Disease Act of 1919, as amended in 1927. When the first work was taken up in 1919, disease was widespread among the many apiaries along the Apalachicola River. The work of the apiary inspection department has been continued from year to year, with very good results. In your section alone, i. e., the counties from Escambia to Columbia, there are over 500 beekeepers operating over 25,000 colonies of bees. The honey produced along the Apalachicola from the white tupelo bloom is known over the country for its excellent flavor and absence of granulation.

ENTOMOLOGICAL DEPARTMENT

The Department of Entomology confines its activities to the identification of the specimens sent in by the field agents of the Board and growers.

With this brief resume of the activities of the Plant Board, you can readily see that your interests are being taken care of by the several departments of the Board.

HOME FRUIT GARDEN

H. K. Miller, Monticello

A request was made of me to present a paper, at this meeting, dealing with The Home Fruit Orchard and with special reference to North Florida. It was with considerable reluctance that I agreed to undertake a commission of this nature, feeling that the subject deserved the consideration of one far more capable than myself both in the matter of possessing the essential information and in fluency of expression. How be it, I am here to treat briefly of an institution once held in great favor and deservedly so for it paid big dividends; material dividends, as well as dividends in delightful satisfaction, recreation and absorbing interest to multitudes of other generations. This institution is not much in evidence in this section at the present time, indeed one may cover many miles without seeing anything to remind him of the home orchard which years ago was considered an essential to every home.

When I looked over this program I discovered that my orchard had become quite fashionable, having been transformed into a Fruit Garden. Well orchard was a mighty good word when I was a youngster and knew what it meant to eat too many green apples. However antiquated and out of place in this new day, it is a word that is enshrined in that classic, "The Old Oaken Bucket," and in this charming setting it is destined to thrill the heart and recall cherished memories for all time to come. Garden is an ultra popular word today, and so was it a word par excellence in the dim past and found place when a description of Adam's first domain was set to English. A word of such antiquity may very properly account for its present popularity. We are not so much concerned with the popularity of the word garden, but a distinct service will be performed if by any means we can bring about greater popularity of the actual home fruit garden. The decadence of the once popular and well nigh indispensable home fruit garden can be accounted for, in part, by our tendency to great commercial expansion, mass production, specialization and improved transportation facilities. Not so very many years ago to secure adequate supplies of fruit one was compelled to produce his own or depend upon a supply from nearby neighbors. But along with the development of our congested centers and rapid transportation facilities, fruit growing became a commercial enterprise. Specialization in this gave rise to fancy fruit of great variety. The introduction of insect pests and fungus diseases made it more difficult to produce good fruit at home. During the past few decades these factors have well nigh eliminated all effort at home growing of fruit in cities and towns and even the farmers have for the most part concentrated their efforts to producing field crops, all depending on the store for a supply of fruit.

Many reasons exist why all this tendency may not be reversed and the home lot be made to yield such fruits as are adapted to its environment. We should eat more fruit. The medical fraternity is virtually unanimous in its endorsement of this for health's sake. Be it to his everlasting credit the physician takes greater pleasure in keeping his clients well than in prescribing palliatives. I wager it was some good old family doctor who coined the expression, "an apple a day will keep the doctor away." Emphatically, green apples not intended. One growing his own fruit will naturally indulge in a liberal use of it and doubtless prolong his allotted days.

With the enormous use of power in our times the hours of labor for most people are some less than formerly and more opportunity exists for giving attention to a garden. The time may be at hand when many of us may find it advantageous to economize, and growing our own supplies of fruit offers one way of doing so. Thanks to our research experiment stations, factors which were partly responsible for the abandonment of home fruit production are now not so formidable as heretofore. Knowledge of pest and disease control is available and equipment for spraying or otherwise putting into effect control measures can be had at moderate cost.

A little relaxation through the care of a garden may become just as absorbing and interesting as a game of golf and possibly more profitable. It gives one quite a thrill to get the upper hand of some fungus, a borer or a pernicious scale and bring in the bacon in the guise of a basket of perfect, luscious fruit.

Some years ago the National Nursery Association, in order to stimulate a more general planting of ornamental and other nursery products, and thereby add to the beauty and attractiveness of American homes, adopted the slogan, "it's not a home until it's planted." Doubtless most of you have seen this used in current advertisements. This has certainly been very effective and has had a marked result in the beautification of home grounds throughout the entire continent. However, I believe many of our home owners have overlooked much that was implied in the slogan.

Believe it or not, the fruit garden is just as essential as the flower garden in making the home appealingly complete. Even the vegetable garden plays a prominent role in this connection. The tendency throughout the United States toward beautification of homes by planting flowers, shrubs and conifers has been gaining momentum with the passing of each planting season and the whole aspect of our habitations has improved enormously during the past decade.

What is now needed is the creation of similar interest in our back lots where beauty may be combined with utility in the building of fruit gardens that will appeal both to our sense of harmony and appease our palate.

It is astonishing to what great utility the vacant spots in our back yards may be put in the way of providing the home with fruits, and relieve the strain on our purses. Furthermore it is remarkable how an abundance of fruit will lessen the need for other and less desirable food products and, at the same time, give us the all essential vitamines and other elements which promote a healthful existence. By growing our own there may be also supplied much exercise, relaxation and interest; all promoting a better acquaintance with, and love for, home, and adding greater zest to living.

In this region, North Florida, which has aptly been termed the "Eden Belt" it is possible to grow a considerable variety of fruits. Indeed by including some of the small fruits it is entirely feasible to have fresh fruit of some kind from your own garden each day in the year. It is best for us to have a considerable variety of fruits to avoid becoming surfeited with too much of any one thing. We are altogether too prone to pass up our own good products for something out of season and grown elsewhere. Such may help in promoting trade but where we have numerous kinds of fruit of our own growing we can nearly always satisfy our craving, and avoid the outlay for foreign products.

As above stated we have a wide range of fruits to select from. True, there are many desirable fruits not adapted to our climate. We are on the border line of two rather distinct climates which makes it possible for us to grow some things better adapted to either a colder or a warmer section. Such things may be grown at considerable risk and at best with indifferent results.

The apple is a case in point. It will occasionally fruit in this section but is too uncertain to be included in a list of fruits for North Florida. So we rule out one of the most universally desirable fruits. In time a variety may be found or created that will answer our needs. Some future Burbank may attend to this and supply the deficiency.

The banana on the other hand belongs to a more tropical climate. It will occasionally succeed in passing through our winter unharmed and fruit. It is worthy of planting for its ornamental effect even if it fruits only on rare occasions. Among the fruits the fortunate dwellers of North Florida may rely upon is the peach. There are drawbacks, including root knot, unseasonable frosts, scales, borers, fungi, etc. However, these are not too formidable to prevent one with a little determination having luscious peaches from his garden most every year. Care in the selection of varieties is necessary and should largely be confined to the following, Georgia Belle, Hiley Belle, Elberta, Greensboro, Triumph, Jewell.

Our nearest and best substitute for the apple is the pear. Blight has been the greatest menace but there are three varieties that withstand this

disease and yield heavy annual crops with seldom a failure. The Shaw is the most desirable for eating out of hand. The Hood and the Pineapple while edible are better for cooking and preserving. Aside from our native wild plums we are limited to the Excelsior with Terrell the nearest second. The first is very satisfactory and quite dependable.

The fig seems to be our surest and ever present fruit, requiring little care and aside from root knot is rarely affected by disease. Several varieties are in general use. The Celestial, the best and most dependable, but with Brown Turkey, Lemon and Brunswick there is greater variety and a prolonging of season. For preserving the fig is perhaps the favorite in this section, of all fruits.

Among the fruits that should be universally grown where possible is the Japanese persimmon. It is adapted to most any kind of well drained soil and is an enormous producer of excellent fruit. Fully ripe and served cold with cream, it has few equals. Tane Nashi is of first rank. Okame, Tamopan, Triumph, Fuyugaki, Nectar, and Zengi, are desirable and will cover a season from August to January.

During the past thirty years very few seasons have found me without some citrus fruit at Monticello. It has been necessary to take some precautions to make this possible though seldom has it been necessary to use heat. Trees on trifoliata weather most of our winters and have seldom been killed outright when in good condition. The Satsuma is, of course, the most certain fruit to survive but here it is possible to almost always have Grapefruit, Kumquats, Calamondin, Limequat, and some of the round oranges. The Satsuma is at its best in this section and should be more generally planted in a commercial way. I consider it no greater risk in middle north Florida than is taken in growing round oranges in Lake County.

When we add to the above fruits the various grapes that are adapted to our conditions, including those of the Muscadine type, the Pomegranate, Mulberry, Loquat, Blueberry and other small fruits is it not remarkable that so few of our people have yet become Fruit-Minded.

It appears to me that the time is ripe to instill into the owner of every home where a little plot of ground is available, the desire to have his own vine and fig tree and thereby add much to the sum total of his own happiness as well as that of those dependent upon him.

HORTICULTURAL AND OTHER ACTIVITIES OF THE COLLEGE OF AGRICULTURE OF THE UNIVERSITY OF FLORIDA

Wilmon Newell, Dean and Director, Gainesville, Florida

Those of us who are connected with the College of Agriculture of the University of Florida welcome the opportunity presented by this meeting to become better acquainted with the horticultural and agricultural activities in this part of the State and to establish contacts with those who are actively engaged in the development and upbuilding of this great section of our commonwealth.

As many of you have only infrequent opportunities to visit our institution at Gainesville and to become familiar with its work along agricultural lines, we have thought this might be an appropriate time to sketch for you some of our activities, laying somewhat more stress upon those which have a more or less direct bearing upon your own section of Florida.

The College of Agriculture is but one of several colleges making up your state university, but in point of personnel and financial resources it is by far the largest. Its activities are not confined to the campus but reach every corner and nook of the state and it is safe to say that there is not a single farm or farm home in Florida today which is not utilizing either crops or practices emanating from this institution.

The College of Agriculture is engaged in the training of young men in scientific agriculture. It is also engaged, on an extensive scale, in research

work on the multitudinous problems of the farmer and fruit grower and it is further engaged in a systematic but widespread dissemination of information, on farming and home economics, to the rural people of the State.

First of all, a few words as to the education of Florida's young men for agricultural careers.

TRAINING OF YOUNG MEN

It may surprise some of you to hear that only a small percentage of our agricultural college graduates actually engage in so-called "dirt farming." However, such is the case, for agriculture offers today as fine and prosperous a career for the trained man as does medicine, law or engineering.

Graduates of agricultural colleges are in demand for service as county agents, as research workers in experiment stations, scientific institutions and the Federal Department of Agriculture, as teachers in the Smith-Hughes agricultural schools and as horticultural and quarantine inspectors. The teaching forces of the universities and colleges of the country must be steadily recruited from the ranks of college graduates. In addition, large fruit companies, by-product manufacturers and fertilizer and insecticide manufacturers must all have technically trained men.

It is not surprising, therefore, that most agricultural graduates do not go back to the farm and it is no reflection on either the college or the graduates that this is the case. These men are serving the farming industry—though indirectly—with the best of their talents and ability and contributing even more than if they were themselves actual producers of raw farm products.

The very practical man will want to know whether an agricultural education pays in dollars and cents. A survey made some time ago of the graduates of our agricultural college showed they were receiving annual incomes of $4,389. This included those (8 per cent) actually engaged in farming, as well as those holding scientific or commercial positions. A similar survey made of the graduates of the Georgia Agricultural College graduates by President A. M. Soule, showed them to be receiving average annual incomes of $2,769 and that approximately three-fourths of them were receiving from $3,000 to $4,000 a year.

Until the demand for technically trained agricultural men can be quite fully satisfied, only a relatively small percentage of college graduates will actually engage in farming. However, in the latter field there are and will be endless opportunities and advantages to the farmer who has a college training. Agriculture today is undergoing marked changes. The successful farmer of today and of the future most not only know the principles of animal and plant breeding and the chemistry of soils and fertilizers but must also be versed in merchandising methods, business principles and agricultural economics. There is a steady trend towards concentrated farming—the operation of large units of land—using the best in science and engineering to the end that unit cost of the product may be brought to the lowest possible point. In this type of agriculture there will be no place for the untrained man, except as a laborer of the most menial sort.

To those of you who have sons approaching the college age, we would suggest that you investigate carefully the opportunities offered by scientific agriculture before deciding whether to start these boys off in some of the already over-crowded professions and vocations.

At the University we have, at the present time, 207 young men receiving their training in scientific agriculture. In addition to receiving a thorough fundamental education, these young men may, at their option, specially prepare themselves for work in Agricultural Chemistry, Agricultural Engineering, Agronomy, Animal Husbandry and Dairying, Botany, Bacteriology, Entomology, Plant Pathology, Horticulture, Landscape Design, Poultry Husbandry or Veterinary Medicine.

The doors are wide open for any others who are ambitious, earnest and properly prepared to make the most of the opportunities which you, as taxpayers, have provided for them at the University.

AGRICULTURAL RESEARCH

Research is vital to the success and prosperity of agriculture. This is true everywhere but it is particularly true in Florida because of the great variety of products, many of them highly perishable, which are produced within her borders.

The Florida Experiment Station, now a part of the College of Agriculture, has been rendering this service for forty-two years. In the earlier years it could make but little progress because of limited personnel and finances but in recent years has expanded in a gratifying way. Ten years ago there were but eight scientific workers on its staff. Today there are seventy-four. In 1920 there was but one experiment station. Today there are five and, in addition, there are eight field laboratories devoted to the study of problems peculiar to the areas in which they are located.

Among the accomplishments of the Station during past years the following may be mentioned:

The development of quick-maturing strains of the velvet bean, making possible the present wide utilization of this crop in Florida and other southern states.

The development of strains of wrapper tobacco highly resistant to the disease known as black-shank, thereby averting a threatened calamity to the shade tobacco industry of north Florida.

The development, in co-operation with the United States Department of Agriculture, of tomato varieties resistant or immune to nail-head rust.

Control of many Irish potato diseases as a result of studies showing that control is a matter of using disease-free seed.

In co-operation with the State Plant Board, research work which has shown that the activities of the citrus aphis can be largely curbed by cultural practices which regulate the appearance of new growth on the tree.

The introduction of a new crop into the agriculture of any region may have most profound effects. The Experiment Station, again in co-operation with the United States Department of Agriculture, has introduced Crotalaria, now found to be the best soil-building crop to date and possessing also promise of considerable value as a stock food and grazing crop.

A new industry, that of growing tung oil seed, is now in process of growth in central Florida and is the direct outcome of work done by the Station with tung oil trees during the period from 1912 to 1924.

However, the greatest value of the Station's work lies in the constant discovery and accumulation of agricultural knowledge which is steadily passed out to the farming population of the State and in the resulting substitution of exact, precise information for the guess-work of the past.

The research work of the Station covers many fields, including the newer ones of agricultural economics and home economics. The staff is at present engaged in active research work on some 145 major projects or problems. It is of more than passing interest to note that more than half of these, or seventy-seven, are of direct interest to West Florida. These may be classed under main headings as follows: Tobacco projects, four; agricultural economics, six; agronomy, nineteen; animal husbandry, seven; chemistry, five; cotton, five; insect problems, six; home economics, four; horticulture, twelve; plant diseases, seven; sugar cane, one, and rodent control, one.

One of the branch experiment stations and one of the field laboratories are located in this part of Florida. It should be explained at this point that branch stations and field laboratories are component parts of the University's experiment station system and the resources and personnel at the University are all brought to bear upon the problem being studied at the branch stations and field laboratories.

The branch experiment station at Quincy was created by Act of the Legislature approved May 10, 1921, and was established on a tract of twenty-two and one-half acres of land about a mile south of Quincy, upon which a substantial brick laboratory building was constructed, together with a tobacco barn, greenhouse, curing house and other equipment. Though its available funds have at no time exceeded $16,000 a year, the workers there have nevertheless done outstanding work for the tobacco industry, including the development of tobacco strains resistant to black-shank, already referred to, and improvement of fertilizer and cultural practices. Precise and exact information has been secured on many operations in connection with the production and curing of tobacco which have been substituted, generally, for the rule-of-thumb methods formerly in vogue. Work is being steadily continued on these projects as

well as other tobacco problems. In addition, this station has been made use of (as far as available land permitted) for carrying out some of the comprehensive horticultural and agronomic work of the main station at Gainesville.

As a result of the interest of West Florida citizens the last Legislature provided a special appropriation of $10,000 a year, for the current biennium, for enlarging and expanding the work of the Quincy station to make of it an institution devoted to general agricultural problems of West Florida.. Ten thousand dollars of this appropriation has just been expended by the Board of Control in the purchase of 603 acres of additional land of most excellent character. A few thousand dollars more will have to be expended in building, fences, roads and clearing before actual experimental work can be gotten under way on this property but, with continued support by the legislature, we expect within the next two years to have under way at Quincy rather comprehensive experiments with horticultural and field crops which should yield results of much value to this region. Funds permitting, it is also our expectation to initiate live stock work at the same station.

The field laboratory at Monticello was established in 1927, through the liberal and substantial assistance of local interests, and has brought to light much practical information relative to the control of the diseases and insect pests of the pecan.

Aside from its work at regularly established stations and at its field laboratories, the Experiment Station has found it advisable and practical to conduct field investigations in co-operation with interested farmers and growers over the State. In West Florida work of this nature is in progress in connection with fertilizer studies, summer cover crops, winter legumes, cotton and corn fertilizer experiments, variety test work with farm crops and fruits, and cover crop tests and other work with pecans. These field experiments are so conducted as to furnish exact information to the Experiment Station in connection with its research investigations. They are, at the same time, excellent local demonstrations of the value of the practices under investigation. Farmers in almost all of the principal agricultural counties of West Florida are now co-operating in this work.

Finally let me say that the agricultural problems of all sections of Florida are of tremendous interest to the Experiment Station and its staff of workers. We are delighted with the prospect of expanding our work in Northwest Florida and we hope, with your co-operation and continued interest, to serve you more effectively in the future than has been possible, with our limited facilities, in the past.

INFORMATION FOR RURAL PEOPLE

The new information being constantly brought to light by the experiment stations would be of little use if it were not made available for the farming population as a whole. There are many thousands who, for various reasons, cannot come to the University to get this information; nor have they time to come and sit in class rooms and listen to the lectures.

Therefore our College of Agriculture, like every other agricultural college in the United States, has a special division or organization for making this knowledge available and applicable on the farm and in the farm home. It is called the "Agricultural Extension Division" and is best known to you through its representatives, the county agents and home demonstration agents, in your own counties. They are the field representatives of the College, the people who come in daily contact with the farmers and farm women, bringing to them not only accumulated knowledge, but also the latest and most improved methods. Back of these agents is the entire United States Department of Agriculture with its personnel of over 18,000 people. Back of them also, is the Florida State College for Women, as well as the faculty of the University at Gainesville and the scientific staff of the experiment stations.

The county and home demonstration agents are assisted in their work by district agents, or supervisors, and by specialists in boys' club work, citrus diseases and insects, poultry husbandry, dairying, nutrition and foods and marketing.

The agents initiate and carry through, in co-operation with the farm people in their counties, definite programs in soil improvement, farm crops,

horticulture, forestry, rodent control, insect and disease prevention and control, animal husbandry, dairying, poultry raising, rural engineering, agricultural economics, home gardening, foods and nutrition, sanitation, clothing, home improvement, food conservation, utilization of surplus farm products, home manufacturing, farm and home accounting, and community betterment. In these activities, during the past year, 4,754 rural communities participated.

Time does not permit of discussing the beneficial results of these activities, but one or two examples will illustrate their value.

As a result of the emphasis placed on soil building in north and west Florida by using hairy vetch and Austrian winter peas, the acreage of these crops increased from ten acres in 1925 to 5,500 acres in 1930. The estimated yield in 1929-30 was 20,000 tons of green material, or an average of about 8,500 pounds per acre. Where corn followed the plowing under of these crops an increase of from ten to thirty bushels per acre resulted, or an increase over check fields of from 100 to 200 per cent.

During the year, 6,312 women were enrolled in home demonstration work and adopted improved home practices, made improvements in the home or manufactured articles for sale. Six thousand four hundred and fifty-one homes improved sanitary conditions and 9,877 homes were beautified in accordance with the home demonstration agents' advice. Two thousand one hundred and eighty women and girls received instruction in craftsmanship. Women and girls in the home demonstration clubs preserved or canned 993,691 quarts of fruit, meat and vegetables and dried or cured 1,132,418 pounds of the same materials.

Extension education also includes the farm boys and girls banded together in 4-H Clubs. These clubs last year had a total membership of over 13,000. The boys are taught not only agricultural information, but the principles of health, manliness and good citizenship. Girls are instructed in gardening, clothing, health principles and various phases of home economics.

Nor is this work limited to the white population. Similar educational work is carried on with negroes in 14 counties, using for the purpose colored demonstration agents, both men and women.

The Florida National Egg Laying Contest at Chipley, operated by the Agricultural Extension Division, has shown, as nothing else could do, that Florida climate and conditions are eminently suited to poultry and egg production.

In conclusion, let me say that visitors are at all times welcome at any and all of our field laboratories and branch experiment stations, as well as at the University at Gainesville. If those of you who live in this section of the state cannot conveniently visit Gainesville we hope you will at least avail yourselves of the opportunity of visiting the branch experiment station at Quincy, the pecan laboratory at Monticello, the Florida National Egg-Laying Contest at Chipley and, during the summer operating season, the 4-H Club camp located in the Choctawhatchee National Forest.

SATSUMA ORANGE FERTILIZATION

R. W. Ruprecht, Chemist, Florida Agricultural Experiment Station

In looking through the literature on fertilization for the past fifteen years we were unable to find a single reference to the proper way of fertilizing Satsumas. Apparently most of the experimental work with Satsumas has been done by the growers themselves. When we began to study Satsuma fertilization we found the growers almost unanimous in the opinion that it was not safe to apply fertilizer after July, and some thought May should see the last application of fertilizer. The general practice was to apply three applications a year, in March, May and July. Practically all growers agreed that a complete fertilizer should be used but differed widely in the proportions of the different elements, except phosphoric acid which all set at eight per cent in the mixture. As sources of nitrogen many favored cottonseed meal. Some thought kainit a

good source of potash but the majority favored the high grade sulfate.

With these varied opinions as a guide we began two fertilizer experiments with Satsumas in the fall of 1924. One experiment was begun at Round Lake and a second at Panama City. As it was manifestly impossible for us to attempt to solve all the problems of Satsuma fertilization at one time, we centered our efforts on two points. These were to determine whether it was safe and advisable to fertilize later than July, especially with nitrogen compounds, and secondly, how much nitrogen could or should be used to best advantage.

The following fertilizer schedule was followed:

1,	4-8-3	March	3-8-3	May	3-8-3	July
2,	4-8-3	March	3-8-3	July	1-8-3	Sept.
3,	4-8-3	March	4-8-3	May	0-8-3	Sept.
4,	4-8-3	March	4-8-3	July		
5,	6-8-3	March	4-8-3	July		
6,	3-8-3	March	2-8-3	July		

At Panama City an additional plot, fertilized as follows, was added:

4-8-3 March 4-8-3 July 3-8-5 Sept.

Unfortunately, the experimental grove at Round Lake suffered severely from cold injury so that many trees had to be replaced. Four years after the start of the experiment only eighty-seven of the original 180 trees were left. In one case an entire plot had been replanted. At Panama City we were more fortunate. While we had some loss it was not nearly so severe as at Round Lake. These two experiments were discontinued in 1928 due to the lack of funds.

The following table shows the increase in circumference of the trees in the two experiments, each being the increase in three years. In the case of the Panama City grove the figures represent the average of eighteen to twenty-five trees in each treatment, while at Round Lake the average is from eight to twenty-one trees. Originally we had thirty trees in each treatment at Round Lake. Due to cold injury the number of original trees in each treatment was reduced to the above figures.

While there are some differences in the growth of the trees under the different treatments, the differences are not consistent except that the lower nitrogen treatment under Plot six has not made as much growth as the balance of the plots. The high nitrogen plots, two, five and seven have not made any more growth than where what might be termed the normal amount has been added.

One difference that is not indicated by the growth figures was noticed, namely, that there was less cold damage on the plots receiving the fall application of complete fertilizer. In 1927, it was particularly noticed that there was less defoliation on the plots receiving the fall application of complete fertilizer. At Round Lake the heaviest loss of trees through cold was on Plot six, only eight trees out of the thirty originally on the plot remaining. This would bear out the generally accepted fact that a well fed tree can withstand cold better than a starved tree.

Our yield records are too incomplete to be significant. At Round Lake we never did get much fruit, and at Panama City we have only records of one crop. One other crop was picked without obtaining a record due to a misunderstanding.

INCREASE IN CIRCUMFERENCE IN CENTIMETERS

	P. C.	R. L.	MARCH	MAY	JULY	SEPT.
Plot 1,	10.9	11.1	4-8-3	3-8-3		1-8-3
Plot 2,	10.8	12.6	4-8-3	3-8-3	3-8-3	
Plot 3,	9.7	11.2	4-8-3		4-8-3	0-8-3
Plot 4,	8.5	12.4	4-8-3		4-8-3	
Plot 5,	7.9	11.1	6-8-3		4-8-3	
Plot 6,	8.6	7.3	3-8-3		2-8-3	
Plot 7,	9.5		4-8-3		4-8-3	3-8-3

A new fertilizer experiment was begun in 1928 at Chipola Farms on the outskirts of Marianna. The fertilizer scheme was changed somewhat from that followed in the two experiments previously mentioned. In this experiment we really have three objects in view. First, is it advisable to fertilize in September: Second, can we substitute the inorganic forms of nitrogen for the usual mixtures of organic and inorganic nitrogen, and third, is it feasible or desirable to apply all the phosphoric acid and potash for one year at one time and only apply nitrogen alone the balance of the year. The plots are fertilized as follows:

OUTLINE OF SATSUMA EXPERIMENTS

To Determine Whether Inorganic Ammonia Can Be Substituted For Organic

Plot No.	Feb. Am. Phos. Pot.	May Am. Phos. Pot.	Sept. Am. Phos. Pot.
1	4-8-4	3-8-5	0
2	4-8-4	3-8-5	1-8-5
3	4-8-4	4-8-5	0-8-5
4	4-6-4	3-6-5	1-6-5
5	5-12-6	3-12-8	

The ammonia in the above to be half from nitrate of soda and half from sulfate of ammonia.

6	4-8-4	3-8-5	1-8-5

Ammonia in spring one-third nitrate of soda; one-third sulfate of ammonia; one-third tankage. In May, one-fourth nitrate of soda; one-fourth sulfate of ammonia, one-half tankage. In the fall, one-half nitrate of soda; one-half sulfate of ammonia.

To Determine If All Phosphoric Acid And Potash Can Be Put on in One Application and Ammonia Alone Used in the Other Applications

7	4-12-4	3-12-10	0
8	4-16-14	3-0-0	0
9	4-0-0	3-16-14	0
10	4-16-14	3-0-0	1-0-0

This experiment has now been under way two years. The trees are all growing nicely and some have a fair crop of fruit this year. While they were injured to some extent by the cold last winter no signs of this injury are visible today.

The following table shows the average increase in diameter of the trees during the past two years:

Increase in Circumference and Fertilizer Treatment

	FEB.	MAY	SEPT.	INCREASE IN CIR.
Plot 1	4-8-4	3-8-5	0	11.62
Plot 2	4-8-4	3-8-5	1-8-5	11.73
Plot 3	4-8-4	4-8-5	0-8-5	11.33
Plot 4	4-6-4	3-6-5	1-6-5	11.53
Plot 5	5-12-6	3-12-8	0	11.63
Plot 6	4-8-4	3-8-5	1-8-5	10.50
Plot 7	4-12-4	3-12-10	0	10.85
Plot 8	4-16-14	3-0-0	0	12.21
Plot 9	4-0-0	3-16-14	0	11.90
Plot 10	4-16-14	3-0-0	1-0-0	11.06

While we find some differences they are too small to be significant as the results cover only a period of two years. We are continuing this experiment and hope that we will eventually obtain some valuable information for the Satsuma grower.

We hesitate somewhat in making recommendations in regard to fertilizing your Satsuma for anything we say today may have to be changed next year depending on the results we obtain from our experiments. If you will consider the following as suggestions rather than as definite recommendations I will feel freer in stating them. We want you to understand that when we make recommendations they are based on definite experimental results and we feel that you will benefit by following them. Suggestions, however, are based only on our general knowledge of the subject, field observations and incomplete experimental data, and should be used in an experimental way by the grower who feels inclined to do a little experimenting himself. With this explanation I would make the following suggestions for fertilizing your Satsumas.

First, based on our experimental work with the round orange we believe that you can safely use the inorganic sources of nitrogen such as sulfate of ammonia and nitrate of soda in place of the usual combinations of organic and inorganics. This will mean a considerable saving in the cost of your fertilizer for the inorganic sources of nitrogen cost less than half as much as the organic materials.

Second, we believe that you will get better results if you fertilize your trees as late as September with some nitrogen fertilizer. We believe that if your trees are otherwise in a healthy condition, that is, free from insect pests and diseases, that the extra fertilizer in September will help them withstand the cold better than without this fertilizer. This has been our experience in our experimental work and has also been the experience of some growers who have fertilized as late as September.

Until we have more information available it

would probably be better to use the usual formulas, that is, one analyzing about four per cent ammonia, six or eight per cent available phosporic acid and four per cent potash in the Spring, followed with the same formula in May if your trees are young, or with five per cent of potash if your trees are bearing. For September we believe one or two per cent ammonia with six or eight per cent of available phosphoric acid and about five per cent potash will give good results.

Some of you may want to use some of the more concentrated fertilizers which are appearing on our markets and which as a rule can be purchased cheaper per unit cost than the usual formulas. We believe that you would be perfectly safe in using them provided you are careful in distributing them uniformly around your trees. We have used them successfully on the round orange for the past three years.

While the subject of cover crops will be discussed by Mr. Stokes immediately following my talk I just want to state that we believe that no system of fertilization or cultivation of Satsumas is complete without the use of a cover crop at least once a year, and preferably, two crops a year. If you incorporate a heavy leguminous cover crop in the soil in the fall and are not growing a winter cover crop, it might be advisable to either omit the fall nitrogen application or to only apply one per cent.

I hardly feel competent to suggest the amount of fertilizer to use. From our observations we believe that the Satsuma can use and needs more fertilizer than the round orange of equal age.

CONTROL OF INSECTS ON SATSUMAS

J. R. Watson, Agricultural Experiment Station, Gainesville

Last week we sent to a woman in St. Petersburg a copy of our bulletin on citrus insects. Friday I received her reaction, "104 citrus insects liable to get on my citrus trees, almost twice as many varieties as Heinz has of pickles, and I believe they are all there now. Thank Heaven I have only ten trees." She was probably right about at least most of them being there now, and most of them are probably in your Satsuma grove.

Every part of the tree has its pests. Eating the leaves are a dozen kind of grasshoppers, two kind of "katydids,' and "orange dogs." Sucking the sap from the same leaves are four kinds of "whiteflies," "round scale," two kinds of "red spiders," the New Citrus Aphid, the Cotton Aphid, the Orange Aphid, and the Garden Aphid. Down on the stems are "purple scale," "long scale," "soft brown scale," and half a dozen species of sharpshooters or "jassids," which get behind the branches when you approach, like squirrels behind a tree. Further down on the trunk may be the "snow scale" and the "chaff scale." On the roots are liable to be the grubs of two citrus weevils, rare here, common at Miami, and very abundant and destructive in Cuba. Here also may be working "termites" or "white ants," just as they are working in the floors of these new Spanish bungalows built near the ground where it is always damp and dark, just what the termites want. When the blossoms appear they are attacked by thrips, sometimes hundreds of them in the bloom. They may be attacked by "June Bugs." As the fruit gets larger they may be attacked by "rust mites," and as it nears ripeness, by the "Southern green stink bug," "Say's stink bug," and the "variable stink bug," or a half-dozen others, the two species of "leaf footed plant bugs," and many other pests.

But this is not the whole story. Let us consider that grasshopper eating the leaves. Stealthily up the trunk runs the "chameleon," its color matching exactly that of the green leaves, and noiselessly he comes. It is time to be moving, grasshopper, and be careful where you jump; on the ground there is likely to be a good fat toad waiting for you. If you take to flight that hungry "mocker" or "butcher bird" is liable to see you. If you light in the neighboring Satsuma tree likely as not there is a green snake waiting

for you. Besides these larger predators which are awaiting to eat our grasshoppers, but from which he has some chance to escape, there are other more insidious foes, little wasp-like things no bigger than a flea are waiting to lay an egg in him. If they succeed, his doom is sealed. A grub will hatch out from the egg and eat the grasshopper's insides. As he feeds on the leaves of the Satsuma he is liable to take in eggs of the "hair worm," a nematode which will grow to be as long as the grasshopper. (Nematodes, i. e., "Hook worms") in our toes, are bad enough but we have none inside of us as long as we are. We make a big fuss and rub and scratch over half a dozen baby "red bugs" on our ankles. Think how a grasshopper must feel with half a dozen full grown ones under his wings. Then he has bacteria and fungus diseases, fully as deadly as cholera or the bubonic plague which attack ourselves. Taking it all in all, the grasshopper is a mighty poor life insurance risk.

Consider the "green aphids" on the under side of a leaf. Waiting to eat them are a dozen different kinds of ladybeetles; (some of them eat fifty per day) half as many "syrphus flies," and a score of predaceous bugs; wasp-like parasites to sting them; fungus diseases to sweep them off during unfavorable weather from which they have no shelter; dashing rains to wash them off. No way to escape these enemies, no way to fight them off. They make no attempts either to escape or resist. Their only hope is to breed so rapidly that after all these hungry stomachs are satisfied there will be a few aphids left to carry on the species. No wonder that an aphid can be a great grandmother when she is less than three weeks old with 100 sturdy daughters and 10,000 granddaughters.

What is true of grasshoppers and aphids is true of most of those 104 insects. We can safely leave them to their enemies. The real serious insects that are liable to break loose and we are liable to have to fight during the year, can be enumerated on the fingers on your two hands. It is these that we will now take up.

CONTROL OF INSECTS ON SATSUMAS

Insect pests of Satsumas are, on the whole, much the same as those on other citrus, but there is a difference in the relative importance on Satsumas and round oranges, and often in the best way to handle them. The long dormant period of Satsumas, the greater cold risk in the Satsuma belt, and the early maturing of the fruit make desirable some modifications of the procedure usual on round oranges. Some of the worst pests of round oranges in the orange belt, such as the "Florida Red Scale," are of no importance in the Satsuma belt. On the other hand, some pests of Satsumas, such as the "Leaf Footed Plant Bug" are of no consequence on round oranges because they occur too early in the season.

We will first take up the "whitefly." Whiteflies on the whole are much less of a pest today on Florida citrus than they were when I first came to Florida nineteen years ago. This diminution in numbers is due mostly, if not entirely, to the more general spread and abundance of their fungus enemies, particularly the Red Aschersonia and the Brown Fungus. This was emphasized by our experience this year. July and August of the past summer were phenomenally dry. Too dry for the best development of these fungi, with the result that the fall brood of whitefly is the largest we have had in several years. On the whole, whiteflies are a worse pest in the Satsuma belt than in the peninsula part of the state. This is due to the fact that the Entomogenous fungi are not as active here, due largely to two causes. In the first place, the summer rainy season is not as pronounced as further south. In the second place, the small size of Satsuma trees does not afford as much shade as the larger orange or grapefruit trees. These fungi must have humid conditions for their best development. In spite of this, however, these fungi, as well as those which attack the scale insects, are well worth encouraging in our Satsuma groves. One of the best ways to encourage their growth is to keep on the ground, during the summer, a good cover crop. I appreciate that this is undesirable from a horticultural standpoint close to young trees, but we can at least have such a cover crop in the middles beyond the reach of the cultivator as it is

drawn down the rows alongside the trees. A good cover crop encourages the fungi by making conditions more moist in the trees. The hot summer sun, reflected from our sandy soils, dries the atmosphere in the trees to a point where these fungi do not flourish as well. A good cover crop, by preventing this reflection and also by the moisture transpired from the leaves, helps maintain a moist condition in the tree. These fungi are introduced and spread in a grove by spraying their spores into the trees. If you cannot find fungi to use for this purpose in some part of your grove or neighbors' groves, you can obtain the Red Aschersonia from the State Plant Board. Dr. Berger, the entomologist of the State Plant Board, raises every year a large quantity of this fungus to supply the growers. It is best applied in June when the summer rainy season starts.

In considering the prevention of trouble from whiteflies, it is important to consider other host plants than citrus. In Satsuma land there are two that need especial attention; the chinaberry tree and the privet hedges. The chinaberry tree breeds whitflies by the millions during the summer, but when the September brood begins to fly, the mature leaves of chinaberry tree are no longer attractive to them. They swarn out from the chinaberry to lay their eggs on other hosts whose leaves are more green and succulent than those of the chinaberry at this season of the year. A chinaberry tree has no business in a citrus community. They should be cut down and prevented from sprouting. In a case of the privet hedge, such drastic measures are unnecessary. They can be sprayed sometime during the fall. If your neighbor has a privet hedge and shows no particular interest in whitefly; it will pay you to spray his hedge for him. He should be glad to allow you to do this for him as it will benefit his hedge to rid it of whitefly and it will also benefit the citrus growers by reducing the amount of overwintering whitefly in the neighborhood.

In order that we may better understand the control of whiteflies, let us review briefly the main points in their life-history. There are in the main three broods a year, although there is much overlapping, particularly during the summer. The main flight of the adult whiteflies takes place at three different periods. These will vary a little with the seasons and the situation of the groves, but in Satsumaland the first brood will be on the wing sometime in March or early April; the second in June, and the third in the early part of September. This applies to the "Common Citrus Whitefly," which is the only common one in this section. Further south where we have a great deal, and apparently an increasing percentage, of the "Cloudy Winged Whiteflies," whose flights are uniformly later, there are whitefly on the wing over a much longer period. Whiteflies, as you know, lay their eggs on tender foliage of the citrus and a few other plants. These hatch out into "crawlers;" flat little insects which creep around for a few hours, then insert their bills and never move again until they become winged adults. The adult whiteflies are very easily killed, even with sulphur dust, but it is not practical to control whiteflies by killing the adults. One would have to spray every two or three days throughout the entire period of their flight to get all the adults. The eggs laid by adults on tender foliage hatch in about a week. The eggs too are difficult to kill, so it is best to wait until the eggs have hatched and then spray to kill the "crawlers" and very young larvae. The rule that we have always given for spraying is to watch the flight of the adults and when they have largely disappeared from the wing, mark down the date and then wait ten days so as to be sure that practically all the eggs have hatched and then spray. This will bring the spraying sometime late in September. It is not, however, safe to spray trees when the temperature is ninety or above. For young non-bearing trees then, the best time for this fall clean up spray will be in late September, ten days after the whiteflies have ceased to fly, providing the weather is not too hot at that time. But on bearing trees we run into a difficulty here. The oil emulsions have a tendency to delay the ripening of citrus fruits. In the case of an early variety like the Satsuma, this is a serious matter, as the growers want to get their Satsumas to market as early as possible so that they do not come in competition with other citrus fruits. It is therefore best in the case of bearing trees to delay this fall clean up spray until after

the bulk of the fruit, at least, has been picked. However, the spray should be given as soon after this as possible, certainly long before cold weather may be expected, as a recently sprayed tree is more susceptible to cold injury. An oil spray is always more or less of a shock to a tree, and if followed by a freeze, the effect may be serious. Therefore, apply the clean up spray for Satsumas as early as possible in the fall after the bulk of the fruit has been picked. This is usually the most important spray on citrus trees. This does not mean, of course, that citrus trees must always be sprayed in the fall. If there are but few insects on the trees, it would of course be foolish to spray them, but a good thorough spraying at this time of the year should keep the trees reasonably clean all winter.

In March or early April the spring brood of whiteflies will be on the wing, so that in late April occurs another favorable time to spray for whiteflies, ten days after the spring brood has disappeared from wing. But at that time of year citrus trees are usually in a flush of growth with blossoms and young fruit. The spring spraying, therefore, should be postponed until this spring flush of growth has hardened a bit and the trees have gone somewhat dormant before the June flush of growth. This will usually occur in late May or early June. If then the trees are heavily infested with scales or whitefly in late May or early June, and the trees are more or less dormant, a spray of an oil emulsion should be applied at this time. In late June comes the summer brood of the whiteflies, but unless this is exceptionally heavy, it is usually not necessary to spray for this brood. The entomogenous fungi should ordinarily be able to control them, particularly if the trees have been well sprayed, either in September or May. Spraying in the summer time because of the high temperatures and almost daily rains is a difficult and an unsatisfactory procedure. So much for whiteflies.

Now, taking up the scale insects, the "Purple Scale," as on all citrus, is the most common one on the Satsumas. The "Florida Red Scale," which sometimes gets destructive in the round orange belt, is very little in evidence in the Satsuma belt. Since this scale occurs only on the leaves and fruit, a freeze hard enough to defoliate citrus all but exterminates this scale in any region. For this reason, it is not probable that the Florida Red Scale will ever be a serious matter in the Satsuma belt. On the other hand, the "Soft Brown Scale" which is a minor pest on round oranges, is much more troublesome on Satsumas. In many groves it really gives more trouble than does the purple scale. Fortunately wasp-like parasites prey on it very commonly and they often hold it in check. You have all noticed that many of the Soft Brown Scales are almost black in color. These have been attacked by the wasp-like parasites. Ordinarily the spray schedule given above for whiteflies also controls the scale insects, although sprays for scale are necessary when there is not enough whiteflies on the Satsumas to justify spraying.

The next serious pest of Satsumas that we will take up is that of the "Rust Mite." These are not as serious in the Satsuma belt as in the round orange belt, but still are a pest that the growers must watch out for. Fortunately rust mites are very easily killed by sulphur. The chief difficulty lies in their small size, which results in their often getting very abundant before the grower discovers their presence. Because of this fact, many growers adopt the practice of spraying at regular intervals whether they see any rust mites there or not, but this is a wasteful procedure and entirely unnecessary. The economical way to fight rust mites is to provide one's self with a good magnifying glass, one magnifying about ten times is best, and watch his fruit during the susceptible months and when he sees the rust mites on the fruit in any considerable numbers spray or dust. Because of the comparatively short season that the Satsumas are on the trees the Satsuma grower has the advantage over the growers of round oranges in the matter of rust mite control. Rust mites will hardly attack Satsumas before June, but from then on until they are picked they should be watched for rust mites, particularly during dry weather.

During wet weather rust mites are much subject to attacks by a fungus disease. For this reason, rust mites are usually not troublesome during the rainy season of the summer, but if

there should happen to be a let up in the rains, as during July and August of this year, rust mites may give trouble. Sulphur is the standard and cheap preventive for rust mite injury. Not a cure. There are two methods of applying this, either in a form of flowers of sulphur as a dust, or in the form of lime-sulphur as a spray. On the whole the dust is usually cheaper as it is much more quickly applied than the spray. For a Satsuma grove it does not require an expensive outfit. A dust gun costing about $25.00 will answer very well for a small plantation. One of the bellows type, such as the "Fasco" or "American Beauty" is on the whole preferable to one of the crank type. An ordinary cotton duster will, however, do very well. On the whole we have found dusting rather more effective than spraying if not followed by a rain inside of three days. An ordinary commercial spraying usually gives us only about eighty-five per cent coverage. That is to say, if you check up behind a spray crew you will find that they have hit about eighty-five per cent of the foliage or fruit. They ought to do better, but they don't. That is about the average coverage for spraying in Florida. Now with a dust, if a good current is directed into a tree it will spread itself so that a much better coverage is secured. In other words, dusting is rather more proof against carelessness than is spraying, providing one does not attempt it on a windy day. It has been found too that it does not kill out the rust mite fungus as does sulphur spraying. In other words, rust mites will not come back into a dusted grove after treatment quite as quickly as they will into a sprayed grove. On the other hand, lime-sulphur has some advantages. It sticks better than sulphur dust so that if followed by a rain within three days one ordinarily gets a better control of rust mites by spraying than he does with dust. The reason is that neither dust nor spray gets the eggs of the rust mites, but these eggs will hatch in three days and if there is still sulphur on the trees the young rust mites hatching out from these eggs will be killed. There is another advantage in the use of lime-sulphur spray. It helps impart a fine texture to the rind. It colors up the fruit, and apparently hastens up the ripening processes. These advantages of lime-sulphur spray may outweigh the disadvantages, such as greater cost of application. Lime-sulphur is made by boiling together lime and sulphur, usually with steam. The two act upon each other chemically and when the process is finished you have neither lime nor sulphur, but a mixture of different polysulphides of lime. I mention this because there is considerable confusion in the use of the word "lime-sulphur." Some people employ the expression for a simple mixture of lime and sulphur, but it should not be so used. Ten or fifteen per cent of lime is often mixed with sulphur to make it go through the dusting machine better. This mixture should not be called lime-sulphur, as it is very different chemically from the one made by boiling the two together. There is a dry lime-sulphur on the market made by evaporating this solution of lime-sulphur. This is a very different substance from the mixture of lime and sulphur and should be used only as a liquid spray. It is of no benefit as a dust against mites. On the whole, then, whether one dusts or sprays for rust mites will depend much upon his equipment and the size of his grove. If one has a power duster this is by all means the quickest way of combatting rust mites, but except in cases of very large groves one would hardly be justified in buying such an expensive machine for Satsumas only. If one has a power sprayer he can get very efficient control of rust mites by spraying with lime-sulphur. If he does not have a power sprayer he can get equally good results as far as the control of rust mites is concerned by dusting with a hand duster.

The "Purple Mite" is particularly bad in the Satsuma belt and has to be watched over a longer period than does the rust mite. It may appear early in the spring. It sucks the oil from the leaves, feeding on both tops and bottoms of the leaves, leaving them an ashen gray color. The preventive is the same as for rust mites. But they are more difficult to kill than rust mites and dusting sulphur is effective only when the weather is good and hot. During cool weather much better control will be obtained by a spray of lime-sulphur. The closely related "six-spotted mite" which causes large yellow area on the leaves of oranges and grapefruit is not very troublesome in the Satsuma belt. Like rust mites,

these red spiders are more apt to appear during hot *dry* weather.

Another group of insects that the citrus grower must be on the lookout for are certain species of plant bugs: "Stink Bugs" and their relatives. There are two which are particularly apt to injure Satsumas; the "Southern Green Stink Bug," often called "Pumpkin Bug" by Floridians, and the "Leaf Footed Plant Bug." The attacks from these bugs are best prevented by proper handling of the cover crops. They breed mostly on legumes, cowpeas and beggarweed being their favorites. They breed less abundantly on velvet beans and care very little for Crotalaria until pods begin to form. They are very fond of these green pods of Crotalaria. There are several broods of these bugs in a season, but it is the last brood which matures in the fall which attacks citrus, particularly the thin-skinned early varieties, like tangerines and especially Satsumas. In a Satsuma grove a cover crop, if it contains velvet beans or cowpeas, should be cut in August before the Satsumas are attractive to these bugs. The bugs are so fond of the green pods of Crotalaria that they do not ordinarily leave it even for citrus. Trouble from pumpkin bugs where Crotalaria is the cover crop has always been when something has happened to the Crotalaria. A drought or early frost may cut down the Crotalaria, or a heavy wind may strip it of its pods, or the pumpkin bugs may become so numerous that they take the green pods all off the Crotalaria, in which case they will move on to the Satsumas. Particularly dangerous is a mixture of cowpeas or beggarweed with Crotalaria. Cowpeas and beggarweed breed pumpkin bugs in the early part of the summer and as these die down in September, the pumpkin bugs will move in a mass to the Crotalaria pods, sometimes in such numbers as to take the green pods all off, in which case they will move on to the next best thing—Satsumas. I saw last year down a little way south of here a fine illustration of how *not* to manage a cover crop in a Satsuma grove. A man had wanted to compare different cover crops so he planted a third of his grove to cowpeas, a third to beggarweed, and a third to Crotalaria. He could not have had a more happy combination for the pumpkin bugs. They started in early on his cowpeas, when these commenced to die down the beggarweed was ready, and they migrated to that in large numbers. In September when that became less attractive they moved on to the green pods of Crotalaria, which they promptly stripped off, after which they attacked the Satsumas, resulting in the destruction of practically the entire crop. Don't mix either beggarweed or cowpeas with your Crotalaria, or plant them near each other if you can help it. We have found that the *Crotalaria spectabilis* (or sericea), is much less attacked by pumpkin bugs than is *striata*. The pods of spectabilis are so large that the pumpkin bugs can reach the seeds only on one side. Furthermore, the season in which it is carrying pods is very short as compared with *striata* and does not afford time to raise a brood of pumpkin bugs.

Don't let me leave the impression that a cover crop of legumes necessarily means pumpkin bugs. Like most insects, pumpkin bugs have their enemies, the most efficient of which is a large fly; it looks something like the "yellow fly" which bites our heads, but is darker and has its legs covered with long hairs so they look like a feather. We might call it the "feather-legged fly." This fly lays its eggs on pumpkin bugs, leaf footed plant bugs, and other stink bugs. From this egg a grub hatches out which bores into the bug, eating its insides, and finally killing it. This fly and others often keep down pumpkin bugs, even in a cowpea patch.

The leaf footed plant bug does not seem to breed much on Crotalaria. It does breed on beggarweed and cowpeas. This is a brownish bug with a yellow stripe across its back, with its hind feet flattened somewhat like a leaf; hence, the name, leaf footed-plant-bug. Unlike the pumpkin bug, it usually occurs in swarms. One Satsuma tree may be almost covered with this insect and the neighboring one entirely free. This is very common in the spring and the early summer on wild thistles. These should be destroyed in the neighborhood of the plantation. It is also very fond of sunflowers. One should avoid planting sunflowers near a Satsuma grove, unless he is willing to collect the bugs from it. In other

words, to use it as a trap crop. If, in spite of the precautions with the cover crop, any of these plant bugs get on the Satsumas, they can be collected at a comparatively low cost. Go through the patch in the early morning, when it is cool, with a wide dish containing a little kerosene; better yet a wide shallow net. Knock the bugs off into this. If a net is used, dip it in kerosene frequently so as to keep it constantly wet. By this means these plant bugs can be collected at a cost of only a few dollars per acre.

This about completes the list of real serious insect enemies of Satsumas. The "Green Citrus Aphid," which has caused millions of dollars worth of damage in the round orange belt seems to be slowly spreading into the Satsuma belt. I find signs of it in groves this year where I have never seen any signs of it before. If certain precautions are taken, however, it is not likely that it will ever be a serious pest in the Satsuma belt. The grower of Satsumas has an immense advantage over the grower of round oranges as far as this insect is concerned, because of the long and complete dormant period of Satsumas. The citrus aphis must have tender foliage on citrus. It cannot feed on leaves which are at all mature, or even full grown. It is, therefore, impossible for it to pass the winter on Satsumas. Its native food plant is a species of Spirea: the common "bridal wreath" is the common Spirea planted in Florida. The aphid does not have to have young tender shoots of this plant; it can feed on mature leaves and even the stems. Furthermore, if the weather gets cold enough it will lay eggs on the spirea, but never on citrus. These eggs can carry it through the winter season. Spirea, therefore, in the vicinty of a Satsuma grove should be cut down. If your wife won't allow you to do this, give them a good thorough drenching with an oil emulsion sometime during the winter or early spring. I have never seen a case of serious injury to Satsumas from aphids in North Florida but what I have been able to find a Spirea bush or a round orange tree not far away. Many owners of Satsuma groves plant a few trees of round oranges, especially Parson Browns in one corner of their grove. This is a bad practice and should be discouraged as during a warm open winter these round orange trees can easily carry aphids over.

If the "Cottony Cushion Scale" should get into your grove, the only permanent and satisfactory method of control is to get from the State Plant Board a colony of "Australian Ladybeetles." This has nearly always proven to be not only a cheap but a permanent method of control. In only a few cases has it ever been necessary to introduce this beetle the second time. The State Plant Board aims to keep on hand colonies of these beetles for introduction into groves.

As a summary then, the following measures will ordinarily keep down the common insects of Satsumas:

Spray with an oil emulsion in the fall after the fruit is picked or in May if whiteflies or scales are troublesome. Spread the friendly fungi in June and July.

Watch for rust mites and purple mites during hot, dry weather and dust with sulphur or spray with lime-sulphur if they become abundant.

Maintain a good summer cover crop but mow it in August if afraid of stink bugs.

Cut down all chinaberry trees, Spirea bushes, and (in the spring) thistles around the grove.

FUNGUS DISEASES OF THE SATSUMA AND THEIR CONTROL

E. F. DeBusk, Extension Citrus Pathologist-Entomologist, Gainesville

There are only two fungus diseases of economical importance affecting the production and marketing of Satsumas in Northwest Florida at this time, namely; citrus scab and blue mold decay.

CITRUS SCAB

Citrus scab occurs in the form of rough, corky projections on the fruit and leaves. It is caused by a fungus (Sphaceloma fawcetti) that attacks the very young and tender fruit, leaves and twigs;

resulting, in severe cases, in heavy dropping of young fruit and a very marked increase in the percentage of culls and low grade fruit of the mature crop.

The organism that causes the disease lives over the winter on the scabby leaves and twigs which serve as sources of new infection the following spring.

Practically speaking, a heavy scab infection depends largely upon frequent rains while the trees are blooming and while the fruit is attaining a diameter of three-fourths of an inch, at which stage it seems to have reached immunity. The rains not only create a condition favorable for the development of the scab fungus, but render spraying more or less ineffective in the control of the disease by washing off the spray material.

CONTROL

Citrus scab on the Satsuma orange is being controlled economically by spraying thoroughly and at the proper time with Bordeaux mixture, and in some cases by the use of liquid lime-sulphur. As the control measures are applied primarily to protect the fruit it is rarely profitable to spray non-bearing trees, except in nursery form.

In planning an efficient scab control program, it must be remembered that the young fruits are most susceptible to scab infection immediately after the petals have fallen and that they become more resistant as they grow larger. The greatest loss from scab often results from a heavy infection on the very young, unprotected fruits, followed by heavy dropping, rather than from the disease blemishes, and consequent lowering of the grade of the fruit left to mature. Any very effective control measures must therefore aim at protecting the very young fruit. This calls for a thorough spraying with 3-3-50 Bordeaux mixture, to which is added three-fourths to one gallon of oil emulsion, immediately before the new spring growth is formed and before the trees bloom. This covers the old scab lesions on the leaves and twigs and is the first, and often most important step, in protecting the young fruit. The second spraying with 3-3-50 Bordeaux mixture plus four pints of oil emulsion, should be made when about two-thirds of the petals have fallen, to cover and further protect the young fruit against the disease. If, at the time the second spraying should be made, red spiders are numerous and scab is not inclined to be serious lime-sulphur solution, one gallon to thirty to forty gallons of water, may be used to a better advantage than the Bordeaux mixture. But it should be kept in mind that Bordeaux mixture is much more effective in scab control than lime-sulphur. A few growers have reported very satisfactory control of scab by spraying with lime-sulphur as strong as one gallon to twenty-five gallons of water, just before the trees bloomed and new growth appeared; this being followed by a second application, one to thirty or one to forty when two-thirds of the petals have fallen. There is probably more danger of burning new growth and fruit with these high concentrations of lime-sulphur than with the 3-3-50 Bordeaux.

It is usually necessary to follow the use of Bordeaux oil by an application of oil emulsion, six pints to fifty gallons of water, the following June or early July to prevent serious scale injury. This applies more particularly to a grove in which scale control is difficult or where the scale insects are being controlled largely by the beneficial fungi.

INSTANT METHOD OF MAKING BORDEAUX-OIL

Unless a Bordeaux mixture is properly made, the results from its application will surely be disappointing. Simply throwing some bluestone into a barrel, adding some water and then throwing in some lime, does not constitute Bordeaux mixture; and will not only fail to give control of scab when applied but may seriously injure the trees and fruit.

A very practicable method of making good Boxdeaux-oil mixture is generally known as the instant method. For this method, finely powdered bluestone (copper sulphate) known commercially as snow-form or powdered bluestone, and *chemical* hydrated lime are needed. To make fifty gallons of 3-3-50 Bordeaux mixture, place three pounds of the lime in the spray barrel or tank while it is being filled, stirring continually. When

the barrel or tank is about three-fourths full, add three pounds of the bluestone, while the stirring or agitation is kept up. Add the required amount of oil emulsion and water to bring the total volume up to fifty gallons, while the stirring is continued.

Hydrated lime which has become air-slacked should not be used. In making lime purchases for making Bordeaux, specify *chemical hydrated* in air-tight containers. If the lime is handled in such a manner as to allow it to become even slightly air-slacked, increase the amount used to four and one-half pounds, making a 3-4½-50 formula.

If the "standard" method of making Bordeaux mixture is preferred, full instructions for making same may be obtained by applying to the Agricultural Extension Service, Gainesville.

Bordeaux mixture should be used the same day it is made, as it deteriorates very rapidly with age.

BLUE AND GREEN MOLD DECAY

There is another fungus disease which may be considered of minor importance at this time, but which will no doubt grow in importance as the production of Satsumas increases in volume. This disease is commonly called blue mold decay, even though it is often closely associated with green mold, and is generally classed as a transit disease, because it rarely attacks fruit to any great extent until after it has been clipped from the tree and starts on its long and often perilous journey to the consumer. The disease is due to species of fungi (Penicillinum) which do not have the power of penetrating the rind of a sound, healthy Satsuma. The decay therefore depends upon cuts and abrasions on the fruit, through which spores of the fungi enter and develop the disease. These wounds in the rind of the fruit are largely the result of careless handling, and are traceable, in a very large measure at least, to the picking and handling of the fruit from the tree to the car.

In picking, and handling, the rind of the fruit—the natural seal against blue and green mold decay—is broken by clipper cuts, long-stem punctures, plugging by pulling, finger nail scratches, nail punctures and various other forms of bruises and injuries. It has been variously estimated that sixty-five per cent to eighty-five per cent of these fruit wounds result in decay before the fruit reaches the consumer.

CONTROL

It can readily be seen that the control of blue mold decay depends almost entirely upon careful handling of the fruit through the picking, hauling and packing operations. In picking, clipper cuts and long stems should not be tolerated. A clipper cut means a decayed fruit; a long stem may puncture several fruit and result in their loss through decay. Pickers and packers should be required to wear gloves to prevent finger nail scratches on the fruit. Field crates should not be filled too full, and should not be dropped in loading and unloading. The Satsuma is a very juicy and heavy orange; only a short drop will bruise it. It is perhaps needless to say that all packing machinery and equipment should be kept in such repair as to function properly and thereby reduce to the minimum injuries to the fruit.

Let me repeat; the control of blue mold decay depends very largely upon careful handling of the fruit from the tree to the car. Various treatments are being applied to reduce blue mold decay, but an ounce of prevention is worth many, many pounds of cure.

THE SILVERHILL: A PROMISING AND APPARENTLY HARDY STRAIN OF SATSUMA ORANGE

Walter T. Swingle, Principal Physiologist, and T. Ralph Robinson, Senior Physiologist, Office of Horticultural Crops and Diseases, U. S. D. A.

The Satsuma orange widely planted in the Gulf Coast region from Texas to Florida, is the hardiest type of orange grown on a commercial scale in the United States. It was introduced into this country from Japan where it is known as the Unshiu Mikan.

Although the Satsuma orange has been grown in the Uitned States for nearly fifty-five years (it was first introduced by Dr. Geo. R. Hall in 1876) there has been until recently no evidence that the several different strains or varieties of Satsuma orange showed any differences in hardiness.

In connection with the citrus breeding work that has been under way for many years by the Bureau of Plant Industry, a number of hybrids between Satsuma oranges and other citrus fruits were made in 1908 and 1909 in northern Florida. The seeds from these cross pollinated fruits were in part true hybrids and in part seedlings very like the mother variety. Seedlings of the last type, commonly called "false-hybrids," are known to arise from the tissue of the mother plant that surrounds the embryo sac. A mass of cells arising from the nucellar tissue grows into the embryo sac and there develops into a false-embryo, utilizing the special nourishment provided for the embryo, and sometimes even displaces and consumes the embryo itself. Occasionally the true embryo persists and germinates as a seedling along with the false seedlings, i. e. seedlings that have arisen from the tissues of the mother plant.

These false-hybrid seedlings show many evidences of being profoundly influenced by the nourishment they have received when still young. For example, such false-hybrid seedlings always show cotyledons, the same as the true seedlings, and the same curious leaves intermediate between cotyledons and the ordinary foliage. Furthermore, they almost invariably develop long and powerful spines, even though arising from a fruit borne on a branch, almost, if not quite, spineless. There is much evidence to show that such false-hybrid seedlings although representing in the main the mother variety, have undergone a rejuvenescence, probably because of the special nourishment received by such false-hybrids while still in a very young condition. It is possible that varieties long propagated by buds and more or less enfeebled by old age may possibly recover their pristine vigor by propagation through false-hybrid seedlings. At any rate, some of the false hybrid Satsumas that originated in 1908 and 1909 have shown vigor, and what is more important, unusual resistance to cold. Some of these hybrids were planted at Eustis, Fla., in 1911 and at Silverhill, Ala., in March, 1921. At both these places these false-hybrid seedlings showed exceptional vigor and at Silverhill they have given evidence of possessing a considerable degree of hardiness. One of the hybrids, C. P. B. No. 7272, was planted both at Eustis, Fla., and at Silverhill, Ala., in sufficiently large numbers to give a fair reading. In one fair-sized planting and two smaller ones near Silverhill, Ala., the trees have gone through three severe freezes with very little injury beyond defoliation.

In 1924 the temperature fell to thirteen degrees F., January 6; and to fourteen degrees on January 7. The young trees of No. 7272 were defoliated but otherwise uninjured, and by May of that season were fully leafed and in good condition. Two freezes occurred in 1928, the lowest temperature, fifteen degrees, occurring on February 2nd and 3rd. Little, if any injury was sustained by these false-hybrid trees beyond partial defoliation. Finally in December, 1929, and January, 1930, all trees by this time of large size and in full bearing went through a very disastrous series of freezes with temperatures falling to twenty degrees on December 3, twenty-one degrees on December 4, and twenty-five degrees on the 5th. Later in December the temperature fell

to fifteen degrees on the 30th, warm weather ensuing for about two weeks; then, on January 19 the temperature dropped to sixteen degrees. This severe freeze following warm, growing weather, caused great injury to ordinary Satsuma trees in this part of Alabama but the false hybrid showed no injury beyond defoliation except in case of a few trees that had been scale-infested and were in a weakened condition when the freeze hit them.

Ordinary Owari trees, growing alongside in the field and planted the same date, were severely injured by all of the freezes mentioned above, and there can be no doubt but that this false-hybrid is distinctly hardier than the ordinary Satsuma varieties.

Since the hardiness of this false hybrid (C. P. B. No. 7272) was first brought clearly to light at Silverhill, Ala., it is proposed to name it Silverhill.

The Silverhill Satsuma produces fruit of the same size and appearance as that of the Owari variety. The fruit ripens possibly a few days later but on the other hand keeps rather better than the Owari. It can, however, be picked, sized, packed and marketed along with the main crop of that variety without difficulty.

The Silverhill tree grows faster than the Owari, is rather more subject to the attacks of the scab fungus (*Sphaceloma fawcetti* Jenkins) and is also somewhat later in coming into full bearing than Owari. Instead of beginning to fruit at four years of age, as the Owari does, about six years were required before these trees produced a crop. The susceptibility to scab resulting from rank vegetative growth probably contributes to this delayed fruiting. Effective control of scab secured by one or two additional sprayings with Bordeaux mixture, may possibly result in earlier fruit production.

The Silverhill tree is of an upright habit of growth, in contrast with the more drooping habit of the Owari and capable of carrying a large crop when in full bearing.

In spite of the drawbacks noted above, it is believed that the Silverhill is promising enough on account of its hardiness to warrant its being tested on a small scale by the Satsuma growers of the Gulf Coast region.

No nursery stock of this variety is at present available, but budwood in limited quantities will be supplied at the proper budding season to Satsuma growers and nurseries. It is not recommended that large plantings be made of it at present, but rather that a few trees be planted for testing alongside the ordinary Owari Satsuma.

CULTURAL PRACTICES IN PECAN ORCHARDS

C. A. Simpson, Monticello, Fla.

The subject assigned, is a very broad subject and hard to treat in a short paper, and yet cover the ground. Men have spent most of their lives trying to work out a definite program of cultural practices for a pecan orchard, and are not satisfied yet. Also the practice that may be best where rainfall averages sixty inches per year, may not apply where rainfall is but forty-five inches.

The main thing to keep in view is to grow good healthy trees that will produce nuts. Whatever it takes to produce that result for you, is the proper cultural practice.

About 1905, when pecan trees were first planted in orchards to a considerable extent, it was thought they would not require very much cultivation or fertilization. In more recent years it has been demonstrated that the owner who gives his pecan trees the best cultivation and fertilization, who turns under sufficient leguminous cover crops, is the one who gets the most nuts.

It is worth while to select your best land on the farm for the pecan orchard. Land that has been under cultivation less than two years should not be used. In Jefferson County, Florida pecans seem to do best on Norfolk fine sandy loam, and on Orangeburg type of soil.

As most of our cultivated land is rather low in humus content it is preferable to turn under

at least one summer and one winter leguminous cover crop, before planting the pecan orchard. Most people, however, cannot delay the planting, and it is necessary then to build up the humus content of the soil as the orchard grows. This can be done by sowing the cover crops in strips along the tree rows, and gradually increasing the width planted, until the entire middle is in the cover crop. Pecan trees will not bear profitably with a humus content much below one and one-half per cent, and it should be built up to at least two per cent.

For the young orchard more frequent cultivation is required than for the older bearing grove. For North Florida, cultivation should begin about the middle of March. The tree rows of an orchard up to five or six years old should have clean cultivation each year, up to about June 15th to July 1st, at which time your cover crop should be sown. This cover crop should be thoroughly disced or plowed under before frost, to avoid fire. It should not be turned under before the middle of September, as otherwise it might cause late growth, which in turn, might cause winter injury.

Until the trees are about six years old, it is better to have farm crops in the middle of the rows, than to have the ground idle. The farm crops, however, should be well fertilized, and where possible, a legume should be planted in the farm crop middles, at the last cultivation. Or if velvet beans are used with corn, they of course can be planted early. All crop residue should be thoroughly plowed or disced under not later than the first frost. It is not best to grow farm crops in the orchard at all after the trees are about six years old.

For the bearing grove the best cultivator to use is the tractor double-acting disc harrow. The orchard should be harrowed once every two weeks from the middle of March until the summer cover crop is planted. If no summer cover crop is planted, weeds and grass can grow in Florida during the rainy season, but when that is over cultivation should again start and continue till about September 1st. Where a summer cover crop is planted in a bearing orchard it should also be disced under soon after the rainy season ends, or during the latter part of August.

If the bearing orchard has reached a point where the soil contains one and one-half to two per cent humus, then a winter cover crop each year of Austrian winter peas, or Hairy Vetch will be sufficient to keep the soil supplied with humus. Cow peas, if desired, may be used as a summer cover crop until time to expect nuts from the young trees. They can not be used after this period, as they are hosts for the common pumpkin bug, which will injure the nuts, and produce kernel spots. The best summer cover crop to use, whether the orchard is young or bearing, is Crotalaria spectabilis, using about seven pounds of seed per acre. This Crotalaria has been tried for several years in Florida with excellent results. It gives you three or four times as much green weight as cow peas or velvet beans, and is much easier to disc under, as the plants are very brittle. This can be sown any time after danger of frost is past in the spring, and up to July first. Probably the best time to plant in a bearing orchard in North Florida, is about the middle of May. Fifteen tons of green weight per acre is not at all an uncommon yield from this new legume, which would be the nitrogen equivalent to 800 pounds of Nitrate of Soda. By discing the Crotalaria twice at right angles with a tractor double acting disc harrow, the ground will be in good shape to sow your Austrian winter peas with a grain drill. Sow about thirty pounds of peas per acre (if drilled), between September 15th and October 15th. Best results are obtained with September planting.

Austrian winter peas usually have a good growth by the middle of March, at which time they should be disced under with a double acting tractor disc harrow, or mould board plow.

Even when you turn under good cover crops, it pays to apply the necessary commercial fertilizer. Following the heavier leguminous cover crops, less commercial nitrogen is necessary.

For young and bearing orchards that have not been planted to leguminous cover crops, an application of a commercial fertilizer analyzing about 9-5-3 is advisable. This fertilizer should contain both organic and inorganic material. The

rate of application depends on the age and growth condition of the trees. The application should be made about two weeks before growth starts in the spring. When a winter cover crop is used it will be best to apply acid phosphate at rate of 400 to 800 pounds, and sulphate of potash at rate of 100 to 200 pounds per acre, just before sowing time in the fall. This will be very beneficial to the winter cover crop, does not leach, and will be there when needed by the trees in the spring. Then you will only have to apply the commercial nitrogen in the spring, instead of the complete formula.

In a good crop year, some successful orchardists apply five to fifteen pounds of Sulphate of Ammonia per tree, after the nuts are set. This is in addition to 1,000 pounds to 1,500 pounds of complete commercial fertilizer per acre. All this is added even though the humus content shows better than one and three-fourths per cent, and leguminous cover crops used each year.

So that it will be seen, to be successful with pecans, plenty of humus, commercial fertilizer, and good cultivation is essential.

Unless the new terminal growth is from four to twelve inches, there is little chance of a real nut crop. So the cultural problem in the end is to produce a satisfactory terminal growth, on which the nuts are formed the following year.

One very successful orchardist makes it a rule to apply to each tree the number of pounds of commercial fertilizer to correspond with the square of its diameter. That is for a tree with a trunk ten inches in diameter, he would apply one hundred pounds of commercial fertilizer.

Here is an illustration of what good care will do with a pecan orchard. A man near the Georgia line conceived the idea that his ten year old one hundred twenty acre pecan orchard did not need the cultivation he had been giving it, so he quit all cultivation. One year after that he did get a fair crop, but that was probably due to the trees making the usual final effort to reproduce themselves before dying. The orchard had no care for five years, and pine saplings grew up in it. After five years a progressive orchardist bought this neglected orchard. The first winter he cut down the pine saplings and plowed it. That spring he fertilized it well and planted a leguminous cover crop, in rows, which he kept cultivated till about June 1st. The cover crop was disced under the last of August. This was repeated each year, and in addition, some use of Austrian winter peas was made, and about 1,000 pounds of commercial fertilizer per acre applied each spring. The results were as follows: The first year the orchard produced 1,200 pounds of pecans; the second year 25,000 pounds; the third year 52,000 pounds, and it has produced as high as 80,000 pounds. This orchard has produced about as consistently as any orchard in the South since the new owner obtained it.

The trouble with most all of our orchards is the lack of care. You cannot expect to get anything out of the pecan orchard unless you put something in it.

BLUEBERRIES IN NORTHWEST FLORIDA

E. H. Rawl, Horticulturist, Louisville & Nashville Railroad Co.

We believe that the blueberry in Northwest Florida and other Gulf Coast regions offers possibilities sufficiently attractive to encourage the development of an important industry of this fruit. Notable progress has already been made as discussed before this Society in 1924, by Prof. Carl B. James, then Horticulturist, and now General Development Agent of the Louisville and Nashville Railroad Company. This most interesting article by Prof. James, which is found in the 1924 Proceedings of the Florida Horticultural Society, furnishes us a complete history of the blueberry in Northwest Florida. In my discussions I shall, therefore, frequently refer to the information furnished by Prof. James.

"The term blueberry does not, unfortunately, have as distinct a meaning in our Southland as it should. It, as well as the term huckleberry, is

here more or less indiscriminately applied to various members of at least two, possibly more, distinct botanical genera. The term blueberry might appropriately, as it is in some sections, be applied only to the various species and varieties of the one botanical genue *Vaccinium*, and the term huckleberry applied only to the various members of the genus *Gaylussacia*. For the purpose of distinction, but without giving full technical description, we may say that the fruit or berry in the Gaylussacias (huckleberries) has ten hard or bony seed, that are large relative to the amount of flesh or pulp; while in Vaccinium (blueberries) the seeds are much more numerous, very small relative to the amount of pulp and almost unnoticeable when eaten.

"In developing the blueberry industry in North Florida from suitable native plants, we are there concerned only with certain Vacciniums. We eliminate, because unsuitable, the deerberry or buckberry, the farkleberry or sparkleberry, and the Gaylussacias (huckleberries) which include the tangle or dangleberry. Some of the Vacciniums (blueberries) must also be disregarded as there are several species and varieties growing wild in that territory and unfortunately even then few from which selection for cultivation should be made as known in the different localities under different common names. Some of the names applied to these suitable varieties are: Huckleberry, high bush blueberry, swamp blueberry, June blueberry, rabbit-eye and Arab. This is further complicated by the fact that the same name may be applied to different forms in different localities, and also some of the collectors who might wish to have it appear that they have a monopoly on something superior have coined brand new names, as cluster-berry blueberry, etc."

It appears that there is sufficient acreage of the poor or unselective types of blueberries to supply, within the next few years, the demand for such quality. But the markets are undersupplied with desirable early types of blueberries properly graded and packed.

For commercial purposes further plantings of blueberries should be made of plants propagated from plants possessing the following desirable qualities:

1. The fruit should be not less than one-half inch in diameter.
2. Spherical form of the berry (the flattened form, however, is not objectionable.)
3. Should have a bluish bloom (not shiny black).
4. Earliness.
5. Should have very small inconspicuous seeds.
6. Distinct blueberry flavor (neither insipid or distinctly acid).
7. Prolific productions.
8. Fruit clusters accessible for quick picking.
9. Good shipper (does not wither or "go down" quickly).

Since it is desired that a blueberry should possess the above listed qualifications, it therefore follows that methods of propagation should be discussed. At the present time the more simple and practicable methods of propagation are of special importance to the average grower because there are insufficient reliable nurserymen offering standardized plants.

Rooted Suckers—This is the simplest method of propagation of the blueberry. These blueberries readily reproduce by stooling-out or forming rooted suckers from the underground stem or rhyzome. These new plants can be removed annually and planted out and later these transplanted plants will in turn reproduce more rooted suckers. Any careful grower can practice this method of propagation, and by the use of only a few of the desired plants in the beginning, can within a relatively few years reproduce a large number of the same kind of plants.

Cuttings. This berry is readily propagated by cuttings which are taken during the dormant season—from December to February. The cuttings are made from one-year wood cut about six to eight inches long. These cuttings should be planted four to six inches deep in clean sand. A cheap propagating box, in which the cuttings are to be planted, can be constructed of rough or finished boards. This frame or box should be four to six feet wide and of any desired length, and should be from eighteen inches to two feet high. Burlap is used for a cover to produce partial shade. This box, of course, is

for outside purpose. The soil within the frame is removed to a depth of about six inches and is refilled with clean sand. Such a propagation box, used by some of our growers in the coastal territory, has given practically as good results as more expensive frames or boxes covered with glass, cloth, etc., where rather exact control of both humidity and temperature is attempted.

An expert nurseryman or propagator could obtain successful results in using tender green wood cuttings by constructing suitable box to maintain optimum shading, ventilation, humidity and temperature conditions. This method, however, should not be attempted by the amateur, but left to the skillful propagator.

Tubering. This method of propagation consists of cutting the stems of the old plants into pieces about four inches long and planting these pieces horizontally in shallow furrows in the beds and covering with about four inches of sand and kept moist and shaded. These stem cuts are made and planted during the dormant period. After new shoots have sprung up, the roots will develop from their base.

Stumping. This is a method that is sometimes used. Plants are cut off at about the surface of the ground and earth and sand is mounded over the stump to a depth of about six inches. Shoots developing thereby produce roots, and during the following winter these rooted shoots are separated from the stumps and planted in nursery rows.

In propagating the blueberry it must be remembered that the plant is an acid loving type (seems to thrive best in a soil of p. H reading of five to six) and should be propagated and grown in the ideal acid sand or soil for best results.

Some of us have seen the blueberry industry of New Jersey, and most of us are familiar with the development of wonderful varieties for New Jersey's conditions by selection and hybridization. It was my good fortune this past season to see the Whitesbog blueberries at harvesting, and note the quality of the berries that are produced commercially in that section. It was especially interesting to see how carefully those berries are harvested, graded and packed. Each quart of fruit contains a label denoting the brand and grade and has a covering of transparent cellophane. Of all the different packs of fresh fruits that I have seen, I believe without a doubt this blueberry pack is the most attractive of them all. Further these New Jersey blueberry growers are handsomely compensated for such quality and pack for early in the 1930 season they netted from ninety cents to $1.00 per quart. I was informed that the season's average F. O. B. price per quart would be from fifty to sixty cents.

The above remarks relative to the blueberries of New Jersey, should convince one of the wisdom of making selections and propagating from those best individual blueberry plants of Northwest Florida. Along that line lies great possibilities for progressive growers and skilled plant propagators.

From now on, under a statute recently passed by Congress, a new variety of plant life may bring to its creator the same monetary rewards under similar process of law as have been reaped by the inventors of something new in the way of mechanical appliances. In other words, plants are patentable.

However, the discovery in order to merit a patent must be reproduced by means of cuttings, buds or methods other than seeds or tubers. Such fruits as strawberries, raspberries and blueberries etc., are patentable if new varieties are produced.

There are some people in Nothwest Florida who think that the establishment of canneries for the canning of blueberries is now desirable. There are several important reasons why we believe this should not be done. Of course, some individuals by the use of small home outfits no doubt might have some degree of success in packing in glass fancy packs of jams and jellies for special trade direct to consumers and possibly a few hotels.

The State of Maine has an important blueberry canning industry which is located principally in the county of Washington. In this (one) county the blueberry industry amounts to about one million dollars annually. It was my privilege during the past August to make a trip to the blueberry section of Maine to get first hand information not only of the canning feature but also of cul-

tural methods, etc. I wish to state here that the blueberry of Maine is the low-bush type; in height ranging from six to eight or ten inches. Of the 1928 crop, 91.25 per cent were canned; 8.85 per cent frozen; and .90 per cent shipped fresh.

The prices that the Maine growers received for their berries delivered to the canneries were thirteen cents for 1929 high price crop and eight cents for 1930 low price crop. Therefore, it is seen that growers receive at the canneries prices ranging from $2.56 to $4.16 per bushel.

During recent years the blueberry packers of Maine received their highest prices for their 1929 pack, and their lowest prices for their 1930 pack. The majority of the fruit is packed in No. 10 cans, and the 1929 price for this pack was $12.00 per dozen while the 1930 price was around $8.00 per dozen. With these prices prevailing it is readily seen that the canning of blueberries in Northwest Florida is not attractive. Furthermore, we are informed that our present blueberries of the South cannot be packed in tin on account of comparatively high acid content.

As a matter of information a few additional remarks pertaining to the blueberry industry of Maine might be interesting. The topography of the area varies from moderately rolling to hilly. The soils on the higher elevations are generally a gravelly loam, and in the valleys and near the seacoast a sandy loam or clay. Blueberries are found principally on gravelly or sandy soils that are acid.

The average length of the growing season is from 125 to 155 days. The average date of last killing frost in the spring is from May 11 to May 18 and the first killing frost in the fall is from September 26 to October 11. The average annual precipitation is from thirty-eight to forty-five inches, with eighteen to twenty inches of rainfall during the growing season.

Blueberries are grown on four different classes of land: "Barrens," "Field," "Pasture," and "Woodlands." The blueberry lands are burned over once in each three years. This burning serves the purpose of pruning, and to some extent cultivation. This is very unique and it is thought by some people to be detrimental in the long run in that by continual burning, land that is now ideal blueberry soil might some day become unsuitable for profitable production.

The type or class of soil designated as "Field" gives the highest production, and the first crop after burning is the largest, the third the smallest. The yields, depending on conditions, run from a few bushels to one hundred bushels per acre. The average net cost of producing blueberries in Maine on all classes of land is approximately $2.50 per bushel.

The berries are not picked by hand but are raked or stripped as are cranberries. One man can strip from eight to ten bushels per day on good fields, and the pay for such work runs from seventy-five cents to one dollar per bushel.

A very serious blueberry pest in Maine is the blueberry maggot. Formerly these infested berries were separated in the canneries by use of mchanical equipment. A few years ago the United States Department of Agriculture established the Blueberry Insect Investigations Laboratory at Cherryfield, Maine. At this laboratory life history studies were made and control methods developed. I know of no economic pest more economically and satisfactorily controlled than is this pest by the use of the government's recommendations.

GROVE HEATING

Dr. A. F. Camp, Florida Agricultural Experiment Station, Gainesville

With winter coming on many grove owners are turning their thoughts again to the subject of grove heating either to save their crop of fruit or to protect their trees from actual damage. Unfortunately grove heating in Florida has made for itself rather a bad name but from observations covering many attempts at this practice I am forced to conclude that the most of the difficulty has been with the operator rather than with the practice. Too much work has been carelessly

done with little or no regard to the basic principles or the information accumulated elsewhere. Grove heating is a highly technical job, as technical as running a packing plant, and will tolerate less slipshod work and ignorance than almost any other procedure in grove practice. Too much money has been wasted on expensive equipment that has never been given a fair trial and a realization of this fact will save many a grove owner money in the future.

It is my intention to point out some of the fundamentals that cannot be overlooked if grove heating is to be successfully practiced. It is well for those who contemplate the purchase of equipment for such work to realize that these principles are not office laboratory theories but good hard sound principles that must be put into practice by anyone who is to make a success of grove heating. Do not believe for a minute that grove heating is just going out and lighting a lot of fires and hoping for the best; do not go into grove heating unless you are prepared to follow up your investment with careful study and good sound practice.

Cold protection, in the sense that we are using it here, consists in the actual adding of heat to the atmosphere in the grove. No other method of artificial cold protection has been found to be successful. The idea that a pall of smoke is what is to be desired has long since been exploded and while such a cloud may exercise a slight effect by slowing up thawing it is now generally recognized as a loss of fuel and a nuisance that irritates housewives in the neighborhood.

Because we are dealing with a question of heat a few fundamentals of heat transmission should be understood since they are basic to good practice. Heat travels in invisible waves from the sun to the earth and is in turn lost from the earth to the upper atmosphere through the same sort of transmission. Heat that is transferred in this way is called radiated heat and must strike an opaque object to be absorbed and put to use. In contrast to this we have "conducted heat." You pick up a bar of iron by one end and put the other end in a furnace and the end in your hand becomes hot—from conducted heat. Soil heats the air close to it by conduction but heat leaving by radiation travels to the upper regions without apparently affecting the air unless caught by some opaque object. Its loss to the upper air is variable in accordance with the transparency of the air, the presence of moisture and dust hindering the loss and clear air letting it pass almost undiminished.

The earth loses heat at all times by radiation but during the day this loss is more than offset by the radiated heat coming from the sun which warms the earth. When night comes, however, the earth loses this accumulated heat and cools off rapidly. The air in contact with it is cooled by conduction of the heat in the air to the soil just as the air close to the soil is heated during the day by conduction from the earth. Compared to iron, however, the air is a very poor conductor so that we have a peculiar situation set up. During the day the radiation from the sun warms the soil and in turn the soil warms, by conduction, a very thin layer of air next to it. This warmed air being lighter than cold air rises and cold air drops to the earth and is warmed, until a very thick layer of air is warm. At night the earth as it loses its heat cools the air close to it but because cold air is heavy this air remains close to the soil and because air is a poor conductor the upper air remains warmer than the air close to the soil. Thus we have what we call "inversion of temperature." The air is very cold close to the soil but as one ascends the temperature becomes higher and higher until the limit of the earth's effect is reached and the temperature starts to fall as we go still higher. The height at which the highest temperature is found varies according to conditions and if we always knew the depth of this layer grove heating would be much easier. In practice the highest temperature may be found at any distance up to several hundred feet and it is very difficult to judge the depth of the layer in this state as so little work has been done along this line.

Under perfect conditions, with no wind, we would have to heat all the air that is below the level of the temperature that we desire to hold. Thus if we wish to maintain a temperature of twenty-eight degrees F. and this temperature is found at sixty feet from the ground we would

have a layer of air sixty feet deep to heat. In practice, however, due to the movement of air and other factors such as the loss of heat from grove heaters by radiation to the upper atmosphere it is necessary to put out a great deal more heat than would be actually necessary to heat such a layer of air. The size of the area being heated also has a lot to do with the amount of heat required, a small area requiring more heat per acre than a large area due to the increased length of boundary in proportion to the area.

We come back then to the basic principle that we have a large volume of air to heat and that we must heat it by burning some sort of fuel. People are inclined to over emphasize the question of the type of heater. After all the heater is merely the stove in which the fuel is burned and its virtue lies in its ability to burn fuel efficiently.

Turning for a moment to the question of fuel I want to point out that each fuel has a definite heating value based upon the number of heat units that it gives off when burned. In this regard, and avoiding a technical discussion, ten pounds of coke is approximately equal to one gallon of fuel oil as far as heat produced is concerned; or, put in another way, 200 gallons of distillate equals one ton of coke. Thus if distillate is worth seven cents a gallon it would have the same heating value as coke at about fourteen dollars per ton. It takes about sixteen pounds of wood to equal one gallon of oil.

An oil heater with a bowl containing nine gallons of oil contains fuel equivalent to about ninety pounds of coke, and three coke heaters containing thirty pounds of coke each would contain the fuel equivalent of one such oil heater. Many people are under the impression that such a coke heater adjusted to burn all night will give off as much heat as the oil heater burning so as to burn up its charge in the same time. It takes only a little grammar-school mathematics to see that this is radically wrong. Put in still another way—if it takes sixty nine-gallon oil heaters per acre burning up their entire charge in a night to keep the temperature up to the desired point it is either going to take 180 thirty-pound coke heaters to accomplish the same amount of heating or else some of the heaters will have to be refilled, during the night, a very painful procedure.

A satisfactory heater should burn the fuel, whether coke or oil, cleanly with a minimum of smoke or combustible residue, as either smoke or residue means a loss of fuel as well as a nuisance. The heater should preferably contain enough fuel to burn all night at a satisfactory rate or sufficient heaters should be provided to go through the night in relays without reloading as this is a very unsatisfactory night job. It should be easily lit and easily regulated and should burn at an even rate. Coke heaters are distinctly at fault here as they tend to burn with a rush and to die out quickly so that the curve for the heat produced rises to a peak rapidly and then falls off whereas an oil heater burns at an even rate as long as there is oil in the bowl. Coke heaters are also difficult to regulate as are some oil heaters. Heaters require a minimum of labor to tend them while burning and night labor is usually more expensive than day labor. They should be safe and in this respect some oil heaters have been very unsatisfactory, particularly those with an auxiliary tank set too close to the heater.

In respect to heaters we can learn much from California where grove heating has been carried on, on a large scale, for many years. There the oil heater is almost universally used, and of the oil heaters the so-called distilling heater has a practical monopoly. In this type of heater a small pilot flame in the bowl, fed from air admitted through an adjustable orifice in the cover vaporizes the oil which is burned in the stack, by means of air admitted through louvres. The bowls to these heaters contain nine gallons of fuel and their burning rate is easily controlled by adjusting the orifice that supplies air to the pilot flame. The heaters contain enough fuel to burn all night at good rate and have no auxiliary tanks. Briquet heaters are used in small numbers but are generally conceded to be relatively unsatisfactory. With us the relatively high price of fuel oil may make the coke heater seem more desirable in many instances and particularly where small groves are to be heated; also coke requires no storage tank. Where coke heaters are

used, however, the number of heaters should be at least twice the number of oil heaters that would be required and the amount of labor required to operate will be at least double. Above all, get a heater that has been thoroughly tested and found to be thoroughly practical.

Proper lighters should be provided. Don't try to patch up something out of an oil can. Reputable companies that sell large numbers of heaters have properly designed lighters and these should be purchased. More accidents have come from improper lighting equipment than from any other source. The oil heaters light readily if the directions are followed. Coke heaters should have the kindling placed within three inches of the top of the charge and *not at the bottom* as this produces a much evener burning. Turpentine dross, fat pine splinters and other such materials make good kindling.

As important as the heaters and the fuel is the supply of accurate thermometers. These should be special frost thermometers, specially calibrated for the lower temperature ranges, and should be tested carefully each year by a competent person to make sure that they are correct. Some companies make special frost thermometers that sell at about four dollars each and plenty of these should be purchased. Time and again I have gone to groves that were to be heated and found them either without thermometers or only provided with advertising thermometers that might easily be five or six degrees off. Such a procedure is just as sensible as buying an automobile without a steering gear.

For each thermometer a shelter should be provided and this can be made at the grove by anyone with ordinary ability with a saw and hammer. It consists of a post with a board nailed across the top upon which the thermometer is to be mounted and a board over it to protect the thermometer from the sky. Without such a shelter the thermometer loses heat by radiation and may easily register as much as four or five degrees below the air temperature. *Don't hang thermometers in trees or lay them on the tops of fence posts.* Outside of the difficulty involved in locating them in the dark they will not register the correct temperature. When fall comes put up the thermometer shelters by planting the posts in the ground so that the help can find them without difficulty. Where a large area is to be heated one or two frost alarms which ring a bell when the temperature drops to a certain point are desirable.

We come now to the question of just how we shall go about the work of grove heating. The first question is of course how many heaters to buy and I will have to say that for the north Florida district this is going to be somewhat of a guess. For blocks of ten acres or over I would recommend that at least sixty nine-gallon oil heaters per acre be purchased and that no attempt be made to heat smaller blocks unless they will justify the use of at least eighty to 100 heaters to the acre. Coke heaters will have to be purchased in proportionately larger numbers depending upon their fuel capacity.

In buying heaters for young groves remember that the radiated heat from the stove is effective only if it strikes an opaque object such as leaves, soil, etc. Heating a young grove is very difficult because the trees catch very little of this heat and it is necessary to greatly increase the number of heaters. Young trees also allow for a free movement of air and this greatly reduces the efficiency of the work. On the whole I am inclined to doubt the desirability of heating a young grove as it is so much more difficult than heating the older grove.

The next item is fuel. Purchase at least enough for four full nights' firing and if it is going to take more than four days to get a new supply purchase twice that much. If oil is going to be used it will be necessary to purchase a storage tank of galvanized iron and a tank to go on a wagon. If coke is used a shed should be provided for storage.

At least a month before cold weather is anticipated place the heaters in the field and set up the thermometer shelters. The heaters should be double tiered along the north side and all heaters should be filled. If the oil heaters are new they should be burnt for a few minutes as this will soot them up so they will light easily. If coke is to be used a lot of croker sacks should

be filled or wagons with bin bodies provided so that the heaters can be easily filled.

Having gotten everything shaped up decide on the help that you are going to use and train them for the work that they are to do. They should be taught to read thermometers correctly and quickly and for this they should be provided with small flashlights and taught to read the thermometer without breathing on the bulb or getting a match in its vicinity. They should be trained in the technique of lighting heaters, it's too late to teach them this after it gets cold. Use your best labor for the night work as the refilling of heaters in the daytime is comparatively simple. Many growers make the mistake of using pick-up labor for the actual firing and their regular labor in the daytime, a very dangerous procedure. Each man should be assigned a definite area of the grove and a thermometer placed in that area. *Don't let the men run around in groups.* Each man should stay in his area and the superintendent should do the running around. It should be determined what temperature is to be maintained, twenty-seven to twenty-eight for saving fruit, twenty-four to twenty-five for simply saving the trees, thirty to thirty-two F. for saving bloom. The labor should be instructed to light the heaters as the minimum temperature is reached. They should light part of them at first and more as necessary to keep the temperature just above the danger point. They should be drilled in the idea that they are not to overheat. Keeping a grove at thirty-five or thirty-six when twenty-eight will do the work is a criminal waste of fuel and the operator deserves to fail. Usually the heaters along the north edge should be lighted first and the alternate heaters in the rest of the grove as the temperature falls and more as necessary. If the temperature in a block rises the operator of that particular block should adjust his heaters so that they will not overheat. Keep as many going as possible as many small fires are better than a few large ones. Large fires tend to make an upward rush of gas that breaks up the atmospheric structure and causes the loss of heat. As it warms up in the morning cut off the heaters and refill them during the day for the next night taking care that by night everything is in absolute readiness for operation.

If the above sounds like too much money and work—don't try to go into the heating game for you are sure to lose. Many a grower has failed because he had only fuel enough for two nights and while he protected the grove as long as the fuel lasted it froze on him on the third night. A lot of others have lost all the advantage of their investment because they tried to make heaters for twenty acres heat forty, or because they didn't buy proper thermometers.

If you aren't ready to go into grove heating on the best scale don't go in at all.

LAWN GRASSES AND THEIR CARE

Geo. E. Ritchey, U. S. D. A., Gainesville, Fla.

The subject which has been assigned to me is one of very wide interest in the state and in all sections of the country where the home is the pride of the community. If the number of letters received by the Experiment Station requesting information concerning lawns and their care can be considered as an index to the interest in lawns over the state there is a rapidly growing desire on the part of more and more citizens of Florida to grow better lawns in their homes.

A house, no matter how magnificent and how beautiful, without a well kept lawn surrounding it is devoid of the beauty and hominess of which all of us pride ourselves. On the other hand, a house, no matter how poor, which has a neatly kept lawn as a basis for its foundation, is always inviting and is a thing of pride to its owner. It is appalling how many "yards" exist in this state which are kept bare of grass or vegetation of almost any kind in spite of nature's attempt to grow grass of some kind on them.

Florida is one of the few states in the Union, which with a little effort and money may have nice green lawns twelve months in the year. The

state is particularly blessed with a climate which affords this privilege, and the soil with a little fertilizer properly applied will insure a rich growth of good lawn grass. In addition to the soil and climate, Florida has a selection of grasses from which one may be chosen which is adapted to nearly any condition under which a person would wish to build a lawn.

There are four of these grasses which are adapted to lawns. They are Centipede grass, St. Augustine, Bermuda and Carpet grass.

The Centipede grass was introduced from China in 1918 and has rapidly become a favorite lawn grass of many people in Florida. It is a medium fine leafed grass, dark green in color, and never grows over four or five inches in height. It is not attacked by the chinch bug as the St. Augustine grass is, but does not grow as well in the shade as St. Augustine does. Centipede is propagated by vegetative cuttings only as it does not supply enough seed to make seed production profitable. It is drought resistant and is adapted to most of the sandy soils of the state.

St. Augustine grass is a coarser leafed grass but makes a beautiful light green lawn. It grows well in the shade and is used on the majority of the lawns in Florida. Bermuda grass while considered by many people as a weed is one of the favorite lawn and golf greens grasses of the state. It is adapted to the heavier soils and will make a good lawn on those soils which contain enough clay to hold the moisture or on those soils which are underlaid with a heavy subsoil coming near the surface. Bermuda grass requires frequent cultivation to keep it in the best condition as it thrives best when the soil is stirred occasionally. Bermuda produces underground stems and therefore is hard to kill by cultivation.

Carpet grass has been growing in Florida so long that we have come to think of it as a native of the state. It, however, was possibly introduced many years ago. It is particularly adapted to low lands where plenty of moisture is available. It is propagated by seed and therefore is one of the easiest grasses to get started. It makes a good lawn covering if the lawn is on low ground or if plenty of water will be kept available.

Of these four grasses the Centipede and St. Augustine and often the Bermuda are propagated by vegetative cuttings while the Carpet and the Bermuda may be propagated by seed.

The preparation of the soil before planting is important if a nice smooth lawn is desired. The soil should be stirred, smoothed and well pulverized. If it is largely sand, and a heavy black soil or muck can be obtained, it is well to top dress the lawn with it before planting as the addition of decomposed organic matter to the sandy soils gives a better, more luxurious growth of grass. An application of two or three pounds of muriate or sulphate of potash and ten or twelve pounds of superphosphate and two pounds of cottonseed meal per 1,000 square feet will give a quick start and insure a supply of sufficient plant food elements for the starting of the young plants. After the lawn is planted it should be kept well watered. Our experience at Gainesville has been that good soakings given a lawn less frequently is worth more than light waterings given more often. At any rate do not fail to keep the ground well moist until they are well started.

After the plants have become established and the sod has formed over the lawn it should receive good care if a good rich green lawn is to be realized. In the first place don't forget that a thirsty lawn is never a pretty lawn. The most important factor in good lawn production is water. As I stated in connection with the watering of the new grass heavy waterings given less frequently are more efficient than light waterings given more frequently. When the ground is well watered the moisture goes down where the roots can reach it while if the soil is lightly watered it remains near the surface and soon evaporates off into the air.

Another factor which is important in the production of lawn grasses is fertilizers. The grass must have food just the same as any other plants and this must be supplied in the form of fertilizers. Phosphorus and potash do not leach out of the soil as readily as the nitrogen so it has been found that the application of four or five pounds of superphosphate and one or two pounds of muriate of potash per 1,000 square feet at the be-

ginning of the growing season will be sufficient to keep the plants supplied for the season. This would in most cases be in the spring. Nitrogen fertilizers, however, leach out of the soil so readily that if they are applied in large amounts the nitrogen will be lost. therefore it is wise to break the nitrogen fertilizing into several smaller applications. In Gainesville we have found that the application of two or three pounds of ammonium sulphate or sodium nitrate per each thousand square feet of lawn is sufficient to supply the grass for three or four weeks. Thus if the application is repeated about once a month the plants will be able to utilize the nitrogen to the best advantage. It is particularly important that a constant supply of nitrogen be kept in the soil for the use of the grass, since it is nitrogen which gives the dark green color to the grass and is responsible for a rapid vigorous growth of the leaves and stems.

A lawn mower is a necessity on any place where a lawn is growing. The grass should be mowed often enough to give it the appearance of being well kept and to avoid its looking shaggy. The leaves should be allowed to fall onto the lawn and left to lie there. They contain a portion of the plant food which you add with the fertilizers and in addition they add organic matter to the soils which is so much needed in Florida. If the grass is cut as often as it should be there will not be enough leaves to injure the looks of the lawn but will improve the quality of the grass grown on it.

The grasses which have been discussed so far remain green during the summer but turn brown during the winter. St. Augustine grass shows some greenness in spite of the cold but does not hold its brightness during the winter months. We do, however, have three grasses which will give us a rich green lawn through the winter and then die down in the spring. These are Italian rye grass, Red top and Kentucky Blue grass. All of them grow during the autumn or winter and remain green through the coldest weather we will have in this state. The Italian rye grass is possibly the most popular of the three. It is a grass which has a dark healthy green color and while a trifle coarser than the Kentucky Blue or the Red Top grass it is a fine grass and makes a beautiful covering for a lawn that any owner would be proud of. It does not seem so liable to the attack of Brown Patch as the Kentucky Blue or the Red Top. The Kentucky Blue grass and the Red Top grass are both beautiful fine-leafed, rich green colored grasses. They grow much more slowly than the Italian Rye grass and are seemingly more susceptible to the disease known as Brown Patch.

If you have had a permanent lawn planted to any of the summer grasses such as Centipede, St. Augustine or Carpet grass you can keep it nice and green during the winter by sowing the seed of one of these grasses or a mixture of them right on the surface of your summer grass. It should be sown at the rate of four or five pounds per thousand square feet of lawn. If it is not sown thicker than this and is kept well mowed, it will not hurt your old grass but will be thick enough to keep the lawn green and nice. It is well to sprinkle about one-quarter of an inch of soil over the lawn after you have sown the seed, as this will assist in covering the seed and tend to protect the plants of your summer grass. The seed will, however, grow and give good service if it is sown on the grass and then kept well watered with no top dressing. Above all things keep it well watered at all times whether you put on top dressing or not until it has germinated and has grown enough to make the lawn green. After that time you may treat it the same as any lawn. A little nitrogen fertilizer, as sodium nitrate or ammonium suphate, added at the rate of two or three pounds per thousand square feet once each month will assist in producing a nice greenness on the lawn.

If you have a bare yard and wish to have a nice green lawn during the winter, or your summer lawn is run down and you wish to green it up for the winter, you may do so by loosening up the soil, sowing the winter grass of your choice and giving it fertilizer, plenty of water and caring for it as you would care for any lawn. If it is possible to haul some rotted stable manure or muck onto the yard and work it into the soil it will pay. If you can't afford it, don't let it worry you, go ahead and sow your grass at the

rate of about four pounds or possibly a little more per thousand square feet, rake it into the soil, then turn on the water and keep it well watered until the lawn is green. Don't forget to water the grass and keep it cut close as it will injure the summer grasses if left without mowing.

I presume you are wondering when you should sow the grass to get the best results. It is hard to name a date as it differs in different parts of the state. In general I would suggest that if you have a lawn on which summer grasses are growing the winter grasses should be sown two or three weeks before the old grass will begin to turn to a brown color. This may be the first of October, middle of October or the first of November. It is doubtful if it is usually wise to sow the winter grasses before the middle of October. If you have a yard without grass or with only a little grass you may safely sow the winter grasses the middle of October.

None of these winter grasses will hurt the permanent grasses if they are not sown too thickly and if they are kept mowed closely. They will die out in the spring about the time your other grasses are growing nicely and by adding the complete fertilizer as a top dressing at this time your summer lawn should green up nicely.

RESOLUTIONS

Realizing the great and good work of the Florida State Horticultural Society in the many successful years of its existence and specifically feeling the great advantages, even at this early moment, accruing to the benefit of this part of our State, generally designated as Northwest Florida, as the result of the convention of that Society in Marianna, Jackson County, on the fourteenth and fifteenth days of October, 1930, and

Whereas; it has brought into our midst a most select group of intellects devoted to the unselfish promotion of the foremost of the Natural Resources of our State, giving us the benefit of exhaustive studies, research and experience and

Whereas; this group being representative of all Florida and all sections of Florida, thereby promoting a better understanding and a closer bond of fraternity and

Whereas; the Citizens of this part of Florida, eager to gain a greater knowledge of horticultural products and their ensuing benefits, particularly for those for which this section is so well adapted and

Whereas; the Citizens of this part of Florida, having enjoyed the privilege for the first time, are also eager to extend to all Floridians and to all visitors a full measure of Southern hospitality

Therefore Be It Resolved that the Florida State Horticultural Society be offered the full facilities and most cordially invited to convene in Marianna in 1931 and each year thereafter, that this section of Florida may have the benefits of the Society's deliberations and that all Florida may grow and prosper in happy unison.

F. M. Holbrook,
Charles O. Rieff,
Committee.

FINAL RESOLUTIONS

Whereas, a meeting of the Florida State Horticultural Society has been held at Marianna, and the members have enjoyed a pleasant visit and an excellent program, and

Whereas, the Society is indebted to the people of West Florida and of Marianna in particular for their hospitality, which has contributed in such a large measure to the success of the meeting, our entertainment and comfort,

Therefore, Be It Resolved by those in attendance and assembled at Marianna, Florida, on this the 15th day of October, 1930, that we express our obligation and deep-felt appreciation to the Jackson County Chamber of Commerce and its

Secretary, Mr. Holbrook, and co-operating Committees for their capable handling of local arrangements for this meeting; to the Marianna Woman's Club for the beautiful decoration of the auditorium and to Mrs. McFarland and Miss Godfrey, in particular; to Miss Lucy Neel Dekle, Miss Richardson and the Misses Liddon and others for the excellent musical and other entertainment numbers; to the press, and to the Marianna Floridian, Mr. Charles E. Jones, its editor, for their splendid and most excellent co-operation in handling the publicity for its meeting; to the management of the Chipola Hotel for many courtesies extended our members, and to the many speakers who contributed so well to the excellence of the program.

Be It Further Resolved that a copy of this resolution be published in the Proceedings of this meeting.

J. Lee Smith,
Sam Westbrook,
C. E. Simpson,
T. Ralph Robinson,
Committee.

(Moved, seconded and carried that the foregoing resolution be adopted).

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